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POMONA COLLEGE JOURNAL
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Volume III FEBRUARY 1913 Number 1

The Palms Indigenous to Cuba III.*

ODOARDO BECCARI
FLORENCE, ITALY

ACOELORHAPHE H. Wendl.

H. Wendl. in Bot. Zeit. (1879), 148; Benth. et Hook. f. Gen. pl. III, 882; Becc. in Webbia di U. Mart. II (1907), 107. **Paurotis** O. F. Cook in Mem. Torrey bot. Club. XII, 21; Britton in Torreya, VIII (1908), 239.

The generic name of *Acoelorhaphe* was proposed by H. Wendland in a paper published in the volume for 1879 (p. 147) of the Botanische Zeitung and entitled: "Die habituellen Merkmale der Palmen mit faecherformigen Blatt." Here the genus is sufficiently well defined by the peculiarities of the leaves; furthermore the etymology of the name itself clearly points out the most prominent characteristic by which it is distinguishable from the allied genera, viz., the seed devoid of any intrusion of the raphe into the mass of the albumen. For these reasons I can in no wise agree with Prof. Britton that the generic name of *Acoelorhaphe* must give way to that of *Paurotis* O. F. Cook in Mem. Tor. Bot. Club, XII (1902), 21.

I did not mention the genus *Paurotis* in my monograph of the American *Corypheæ* because at the time of its publication I had not had an opportunity of seeing Mr. Cook's paper, in which that genus is described. However, I feel inclined to follow Mr. Britton's opinion in this respect, namely, that *Paurotis androsana* Cook and *Acoelorhaphe wrightii* really represent but one species. I still remain uncertain, however, whether *A. arborescens* should be considered a distinct species or only a variety of *A. wrightii*. It is certain that *A. wrightii* is a common palm, distributed over a large area, presumably because its small fruits, although covered by a slightly pulpy pericarp, are probably coveted by birds, by whose aid its seeds are speedily dispersed.

Acoelorhaphe wrightii Wendl. in Herb. Berol. ex Becc. in Webbia II (1907), 109. **Copernicia wrightii** Gris. et Wendl. in Gris. Pl. Cub. 220; Sauv. Fl. Cub. n. 2367. **Paurotis wrightii** Britton in Torreya, VIII (1908), 239 (ex parte?).

This beautiful palm, in its general appearance, is quite unlike any other palm, chiefly by reason of its long spadices, which spring straight above the

*This is the third and concluding instalment of Professor Beccari's monograph. The others appeared in Vol. II, Nos. 2 and 4.

crown of the leaves. This palm grows in tufts of several stems of unequal age, but I do not know whether these are produced by off-shoots springing from the base of the older stems, or whether they are independent plants developed from the innumerable seeds, which drop around the mother plants. The stem is rather slender, erect and straight and possibly would remain for a very long time, perhaps for its life time, clothed by the dead leaves, if these were not cut away by man or burnt off by the fires of the savannahs, where this palm grows; in every case the trunk remains covered entirely and permanently down to the very base with the stumps of petiole bases arranged in gentle spirals.

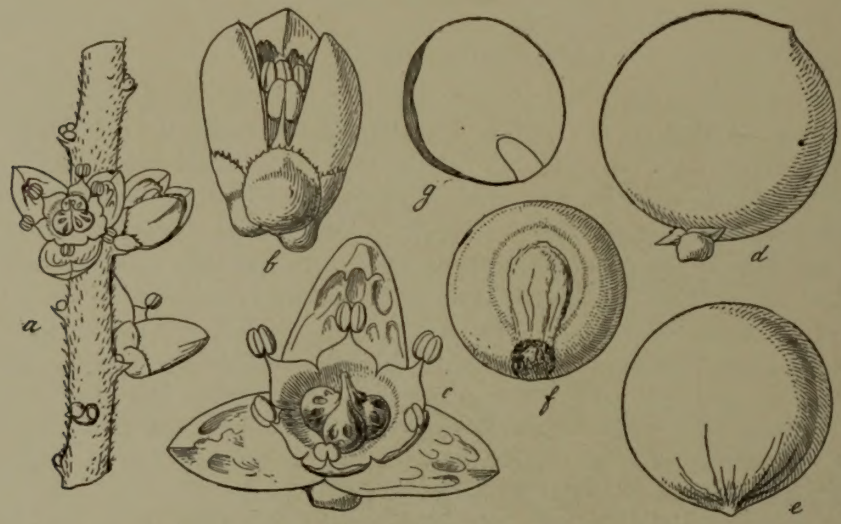

Figure 154. Acoelorhaphe wrightii. a, portion of a flowering branchlet; b, full grown unopened flower; c, flower during the anthesis; d, fruit; e, kernel; f, seed as seen from the raphal side; g, seed cut longitudinally through the embryo. a, b, and c, from a specimen collected by Combs at Cieneguita; d, e, and f, from a plant cultivated at Buitenzorg, Java.

A special feature of *Acoelorhaphe* is the long spadices, which spring straight upwards above the crown of leaves. Each is decomposed into several rather distantly superposed branches or partial panicles, crowded, at first, with innumerable and very small flowers and afterwards with small round fruits.

The type specimens of *A. wrightii* are those of the "Plantæ Cubenses Wrightianæ" n. 3207.

From plants growing at Herradura, in the Province of Pinar del Rio, were taken the specimens distributed under n. 4208.

A. wrightii, very slightly changed in its characters, grows, also, in Honduras, and at Nueva Gerona in the small island, Isla de Pinos. Of this latter, I made the variety Novo geronensis (Webbia l. c. p. 113). It is probably not specifically distinct from the plant of Cuba or the *Acoelorhaphe*

from White Water Bay in Florida, of which I have spoken in Webbia p. 117, and which I had considered as different from *A. arborescens.* It remains, also, doubtful whether *A. arborescens* of Florida should be considered specifically distinct from or only as a geographical form of the type plant of Cuba, and, also, whether *Paurotis androsana* of the Bahamas (of which I have seen no specimens) agrees more with the plant of Cuba or with that of Florida. (Figure 154).

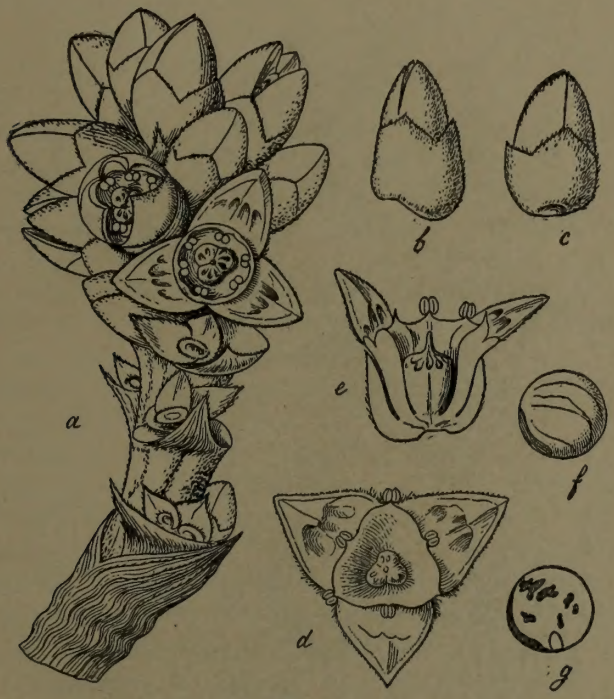

Figure 155. Copernicia hospita. a, the summit of a flowering branchlet; b, c, flower-buds; d, open flower as seen from above; e, longitudinal section of a flower; f, seed, side view; g, the same seed cut longitudinally through the embryo. a, b, c, d, from Wright No. 3216; f, g, from Combs No. 334.

COPERNICIA Mart.

Hist. nat. Palm. III, 242, t. 49, 50 (excl. t. 50 A, I-IV), et Palm. Orbign. 41, t. 1, f. 3 et t. 94; Benth. et Hook. f. Gen. pl. III, 927 (excl. Chrysophila); Becc. in Webbia di U. Mart., II (1907), 140.

The species of this genus indigenous to Cuba belong, without exception, to the section *Copernicíopsis,* or to those of which the spadix has all its divisions, to the smallest flower-bearing branchlets, sheathed in spathes or spathels more or less tubular in their basal parts.

A. Ultimate divisions of the spadix slender, more or less scorpioid.
  a. Spathels, bracts and flowers hairy.
    b. Flower buds ovoid, rather acute, divisions of the corolla equilaterally triangular. *C. hospita*
    bb. Flower buds long-pointed, divisions of the corolla elongate-triangular, acuminate. *C. curtissii*
  aa. Spathels, bracts and flowers glabrous. *C. glabrescens*

Figure 156. Copernicia curtissii. a, the summit of a flowering branchlet; b, flower; c, longitudinal section of a flower; d, fruit; e, seed, as seen from the raphal side; f, side view of the same seed; g, seed cut longitudinally through the embryo. From Curtiss No. 435.

AA. Ultimate divisions of the spadix covered with closely packed flowers, amentiform on the whole, softly and densely hairy and as thick as a man's little finger. *C. macroglossa*

Copernicia hospita Mart. Hist. nat. Palm., II, 243, t. 50 A, f. 5, et III, 319; Gris. Pl. Cub. 220; Sauv. Fl. Cub. n. 2365; R. Combs in Trans. Ac. Sc. St. Louis, VIII, 17, (1897), 471; Becc. in Webbia di U. Mart. II (1907), 172.

This palm is well represented in the herbaria by complete specimens, but nothing is known of its general aspect and dimensions. The *leaves* have the blades glaucescent on both surfaces and covered by a thin coating of waxy matter, which in the dried specimens is easily detachable in very small, narrow flakes. The elongate *spadices* are much branched; the branchlets, and ultimate divisions and flower-bearing spikelets are curved, scorpioid and hairy. The flowers are ovoid, rather acute, and covered with appressed silky hairs externally. The *fruit* is spherical, 13-15 mm. in diameter, (Figure 155).

Specimens of this have been gathered in Cuba by several collectors. At Calicita in the District of Cienfuegos, Prov. of Santa Clara, *R. Combs* n. 334; at Herradura, Prov. Pinar del Rio, *Van Herman.* n. 850; *Wright* Pl. Cub. n. 3216.

Copernicia curtissii Becc. in Webbia di U. Mart., II (1907), 176.

It differs from *C. hospita* by its flowers, which gradually narrow to a sharp point and have the divisions of the corolla elongate-triangular (not deltoid) and acuminate; other minor differences are mentioned in Webbia l. c. (Figure 156).

It is no doubt a second species, which substitutes in the small Isla de Pinos for the more diffuse *C. hospita* of the larger island. It was established on Curtiss n. 435, collected at Nueva Gerona.

Copernicia glabrescens Wendl., nomen in Wright, Pl. Cub. n. 3968; Sauv. Fl. Cub. n. 2366; Becc. in Webbia di U. Mart., II (1907), 170.

In general appearance greatly resembles *C. hospita* and *C. curtissii*, but it is easily distinguishable from both by its smaller, hairless flowers, and by all the different parts of the spadix (branchlets, spathes and axes of the spikelets) being, also, glabrous.

The fruit of this species is as yet unknown. (Figure 157).

It grows at Herradura, Prov. Pinar del Rio (*Van Hermann* n. 904); *Wright* Pl. Cub. n. 3968, without precise locality.

Copernicia macroglossa Wendl. in Kerch. Palm. 241; Sauv. Fl. Cub. n. 2368; Becc. in Webbia di U. Mart., II (1907), 177. **Copernicia sp.** Combs in Trans. Ac. Sc. St. Louis, VIII (1897), 471.

Figure 158 gives a very fair idea of this fine and curious palm, very conspicuous for its large, glaucous and robust leaves, whose blades are borne upon short and robust petioles armed at the edges with large spines resembling the teeth of a coarse saw. The trunk is short, stout and solitary; presumably it would remain permanently covered by its dead leaves, if these were not cut off by man or burnt off by the not infrequent fires in the savannahs, where this palm seems largely disseminated and where it forms the most conspicuous object among coarse grasses and weeds, by the mass of its beautiful glaucous leaves. The trunk remains therefore covered by projecting stumps, the remains of the bases of the dead leaves.

Several spadices shoot out from among the leaves; are somewhat longer than the latter, are very peculiar on account of their innumerable flowers

agglomerated around the ultimate branchlets and hidden by densely hairy bracts, so as to form small woolly catkin-like spikes, as thick as a man's little finger. (Figure 159).

Specimens collected from plants at Guanabacoa, near Havana, bear the n. 2928.

Figure 157. Copernicia glabrescens. a, the summit of a flowering branchlet; b, open flower as seen from above; c, flower; d, longitudinal section of the above flower. From Wright No. 3968.

It has been collected, also, at Calicita, District of Cienfuegos, Prov. of Santa Clara (Combs n. 335), and distributed by Wright under the n. 3969. Ramon de la Sagra first discovered this palm in Cuba in the year 1829 (Herb. De Cand.) and he gives the vernacular name "Yapa". *C. macroglossa* is, according to Prof. Baker, the so-called "Yata" palm.

Figure 158. Copernicia macroglossa.

PRITCHARDIA

Seem. et Wendl. in Bonpl. IX, 260; X, 197, 310, t. 15; Benth. et Hook. f. Gen. pl. III, 928; Becc. Malesia, III, 286, et in Webbia di U. Mart., II (1907), 200. **Colpothrinax** Gris. et Wendl. in Bot. Zeit. 1897, 147.

Pritchardia wrightii Becc. in Webbia di U. Mart., II (1907), 203. **Colpothrinax wrightii** Gris. et Wendl. in Kerch. Palm. 241; Sauv. Fl. Cub. n. 2382.

This palm is sufficiently well known to botanists from the specimens preserved in the principal herbaria of Europe and America, but certainly very few people are acquainted with the most singular aspect it assumes in

Figure 159. Copernicia macroglossa. a, flower; b, corolla laid open; c, calyx; d, bracts; f, growing ovaries; g, the same ovary cut longitudinally; h, fruit; i, longitudinal section of the fruit with all parts in situ; k, seed, raphal side view; l, seed cut longitudinally through the embryo. The figures of the fruit from Combs No. 335; all the others from Wright No. 3969.

its native country as is shown in the beautiful photographs taken by Prof. Baker at Herradura near Havana. (Plates 160 and 161). Here the stems of this *Pritchardia* look like enormous bottles tapering into a long neck and rising from among the grasses. These palms are scattered about in the savannahs, where they are associated with *Byrsonima crassifolia*, an unbecoming crooked tree of the family *Malpighiaceæ*, and with another, also conspicuous, spindle-stemmed palm, the *Oreodoxa regia*.

I have already given a detailed account of the principal characters presented by the different organs of *Pritchardia wrightii* in the "Palme Americane" (Webbia l. c.), and I have now nothing to add to what I have already said there, except some considerations in respect to the singular conformation of its stem. (Figure 162).

Figure 160. Pritchardia wrightii.

Figure 161. Pritchardia wrightii.

The stem of *P. wrightii* is always single and rises quite straight from the soil for a meter or two; at first it is cylindrical and of a uniform diameter of about 30 cm., then it begins gradually to increase in thickness till it attains about twice the diameter of its basal part; afterwards, the swelling of the stem begins to decrease in the same ratio, becoming cylindrical again, but thinner than below the swelling; it continues to lengthen for several meters more, till the trunk attains a total length of 10-12 m. From this manner of growing it follows that in middle aged individuals the spindle-like swelling is more or less mesial, but in plants that have attained a considerable height the enlarged part appears approximate to the base and imparts a very strange and quite unique appearance to this palm.

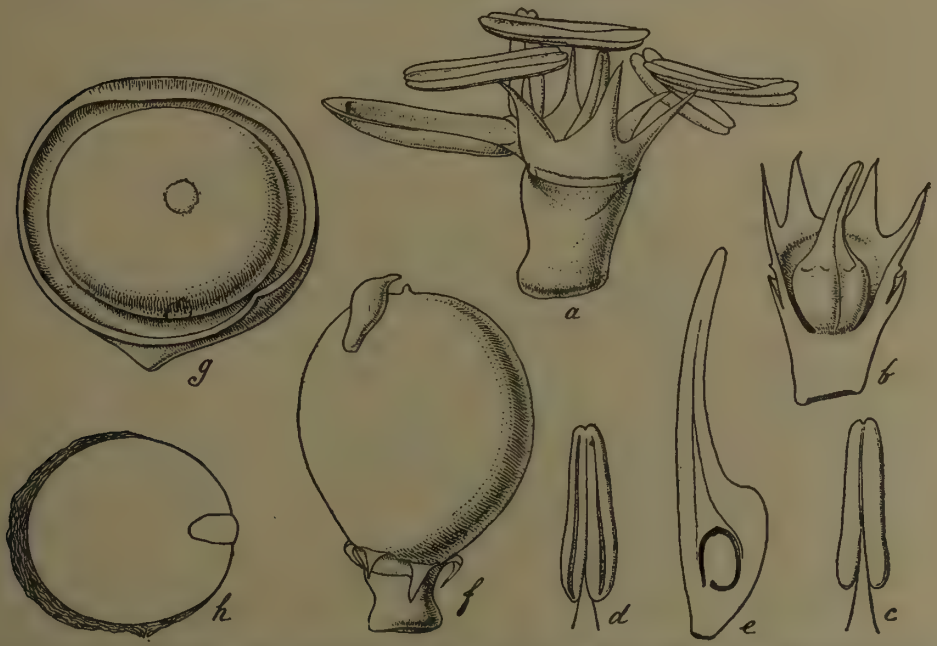

Figure 162. Pritchardia wrightii. a, flower during the anthesis, only one of the segments remains attached to the tube of the corolla; b, longitudinal section of a flower (the segments of the corolla and the anthers are wanting) showing the ovarium entire; c, anther from the dorsal side; d, anther from the inner side; e, one of the carpels cut longitudinally; f, young fruit bearing at its apex the remains of a sterile carpel; g, section of the kernel showing the entire seed inside; h, section of a seed along the line of the raphe and dividing the embryo in the middle. The flowers from Curtiss No. 364, Isla de Pinos; the fruit from another source.

On its lower part the trunk of *P. wrightii* appears (at least from what I can judge from the photograph) covered by a cracked, corky bark, as is the case with *Jubaea, Livistona, Washingtonia,* and numerous other palms; but the swelling and the entire trunk above it have a smooth surface, more or loss distinctly ringed by leaf-scars, but otherwise quite clean to the very base of the crown, for the older and functionless leaves do not remain long hanging down, but soon drop off.

HEMITHRINAX

Hook. f. in Benth. et Hook. f. Gen. pl. III, 930; Becc. in Webbia di U. Mart. II (1907) 243.

Hemithrinax compacta Hook. f. l. c. 931; Becc. l. c. 245. **Thrithrinax compacta** Gris. et. Wendl. ex Gris. Cat. Cub. 221; Sauv. Fl. Cub. n. 2381.

I cannot describe the general aspect of this palm, as there is no picture of it. I have little doubt, however, that it must be very like a *Thrinax*, as the genus *Hemithrinax* differs only and very slightly from *Thrinax* of the Sectio *Typhlothrinax*, in that the stamens have the anthers borne on very short filaments, which, during the anthesis, are reverted or curved downwards, so that the anthers show externally the side that normally is turned towards the interior; the dehiscence of the anther-cells, therefore, appears to be extrorse, while that of the *Thrinax* takes place in the usual way or is introrse. The anther-cells are separated by an unusually broad connective. (Figure 163).

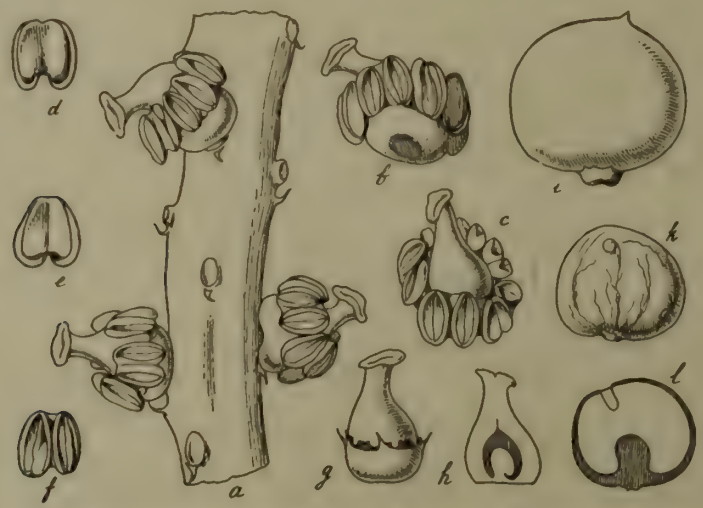

Figure 163. Hemithrinax compacta. a, portion of a flowering branchlet; b, c, flowers during the anthesis; d, e, anthers, dorsal side; f, anther, inner side, becoming external by reversion of the filament during the anthesis; g, flower from which the anthers have been removed; h, longitudinal section of an ovary; i, fruit; k, seed; l, longitudinal section of a seed through the embryo. From Wright No. 3222.

This palm is known only from Wright's n. 3222, and the precise locality in which the specimens were gathered is uncertain. Sauvalle gives for it the vernacular name "Palma Caule".

THRINAX

Linn. f. ex Swartz, Prod. veg. Ind. occ. (1788) 57, et Fl. Ind. occ. I, 614, t. 13; Sargent in Bot. Gaz. XXVII (1899), 83; Becc. in Webbia di U. Mart. II (1907), 247.

Sectio A. *Euthrinax* (*porothrinax* Wendl.)

Seed with albumen traversed from base to top by the raphal intrusion of the integument.

1. Flowers and fruits borne on a long pedicel.

   Fruit 5 mm. or slightly more in diameter. Leaves green on both surfaces, but on the lower sprinkled with very small, light-colored, elongate dots. *T. wendlandiana*

2. Flowers and fruits sessile.

   Leaves slightly glaucescent, or slightly silvery and obsoletely dotted on the lower surface. Fruits 4 mm. in diameter. *T. drudei*

Sectio B. *Typhlothrinax.*

Seed with albumen more or less penetrated by a basal intrusion of the integument, but not traversed throughout from base to top.*

Flowers and fruits sessile. Leaves slightly silvery-white on the lower surface, and, also, closely sprinkled with very small, elliptical, ferrugineous dots. *T. punctulata*

Thrinax wendlandiana Becc. in Webbia di U. Mart. II (1907), 265. **T. martii** Gris. et Wendl. Pl. Cub. 221 (nomen ex Sauv. Fl. Cub. n. 2373. **T. parviflora** (non Sw.?) Sauv. Fl. Cub. l. c. **Porothrinax pumilio** Wendl. ex Sauv. Fl. Cub. l. c.

This is a graceful palm which has the trunk elongate, cylindrical, rather slender, usually slightly bent at the base or ascendent, rising from an enlarged subbulbous base, which is entirely formed of fine rootlets very closely packed together. The surface of the stem is obscurely marked by annular rings and is somewhat rimose. The crown is not very dense and the leaves have their blades borne by slender petioles, which have their bases immersed in a mass of pure white and soft cottony tomentum; the old leaves are suddenly reflexed and hang for a certain time below the living crown.

T. wendlandiana is easily distinguishable among the Cuban species of the genus by its long pedicellate flowers and fruits. The *fruit* is 5 mm. in diameter, and has the surface more or less granulose when dry; the *seed* is traversed from base to top by the intrusion of the tegument. The *flowers* have six stamens with very slender filiform filaments, and long, very narrow, linear anthers.

The *leaf* has the blade green on both surfaces, slightly paler on the lower, which is sprinkled with very small scales, in the form of light-colored linear-elliptical dots.

Perhaps *T. wendlandiana* is not sufficiently distinct, as a species, from the true *T. parviflora* growing in Jamaica; and, probably, it is only a geographical form of this latter species.

It differs from *T. parviflora* mainly by its stamens having the filaments longer and narrower, and by the narrower and longer anthers. Besides, the

*This character is not so important as might be at first supposed, for I have found it rather variable, as in *T. harrisiana,* where occasionally the seed is not completely traversed by the intrusion.

fruits of *T. wendlandiana* seem to be smaller than those of *T. parviflora*, but of the first I have seen none sufficiently developed for exact comparison. In *T. parviflora* the filaments are a little longer than the teeth of the perianth, and have lanceolate bases; and the proportion between the breadth and length of the anthers (in fully expanded flowers) is 1:6-7; while in *T. wendlandiana* the filaments are linear from their bases, considerably longer than the teeth of the perianth, and the proportion between the breadth and the length of the anthers is 1:10. (Figure 164).

The photo was taken at Santa Catalina, Prov. Pinar del Rio, and in that locality were gathered the specimens bearing the n. 3464. To this species belong Wright n. 3219, and n. 3928 of van Hermann, collected near Havana.

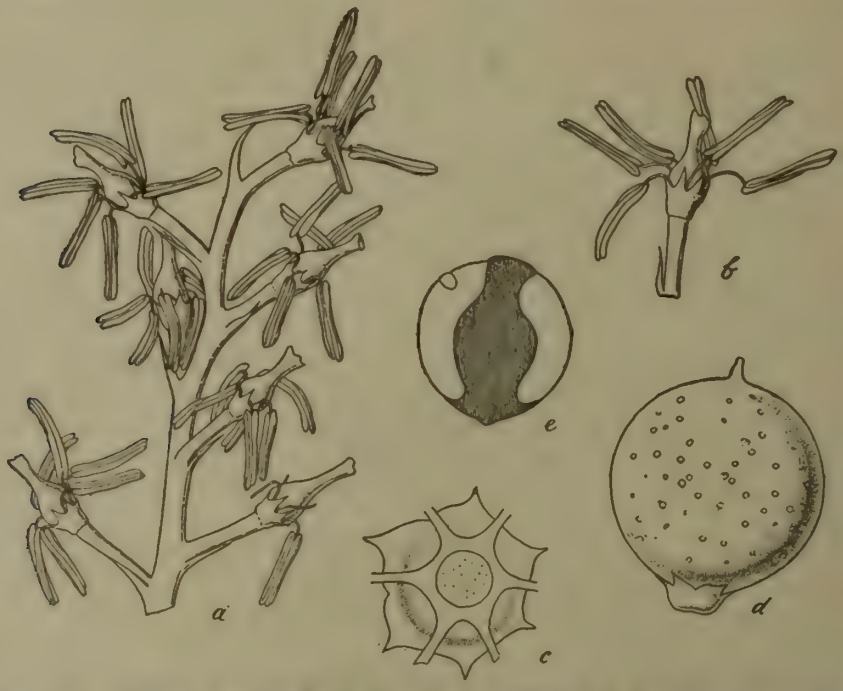

Figure 164. Thrinax wendlandiana. a, apical portion of a flowering branchlet; b, flower; c, fruiting perianth, out of which the fruit has been taken, seen from above, and showing the bases of the filaments; d, fruit; e, seed cut longitudinally through the embryo. From Wright No. 3219.

I consider as belonging to *T. Wendlandiana* some specimens collected by Gaumer in the Mugueres Island in the Bay of Honduras, and another from Gozumel Island, also, near the coast of Honduras. I have, also, just received (February, 1912) specimens of *T. wendlandiana*, which has been recently discovered at Madeira Hummock, near the extreme southern point of Florida, and, also, at Pumpkin Key, by a correspondent of Prof. Sargent.

Thrinax drudei Becc. in Webbia di U. Mart., II (1907), 269. **T. multiflora** (non Mart.) Wright, Pl. Cub. n. 3965.

The *leaves* are whitish or greyish on the lower surface, where they are, also, sprinkled with very small whitish-brown dots, not easily distinguishable without the assistance of a lens; the segments appear to be very closely longitudinally veined by numerous secondary nerves. The *spadices* are divided into several partial inflorescences, which are composed of slender, subulate, straight and rigid branchlets, which form all together rather loose ovoid or oblong panicles. The *flowers* and *fruits* are sessile on the branchlets.

The *fruits* are very small, and hardly attain 4 mm. in diam., but those seen by me are not perfectly mature, although sufficiently evolute to show the albumen completely perforated from base to top; and in this the plant would appear to be quite distinct from *T. punctulata* which it otherwise resembles in its straight, rigid, flower-bearing branchlets, and in its very small fruits. (Figure 165).

T. drudei is known to me only from Wright's specimen n. 3965, which presents no thoroughly mature fruits and no flowers.

Thrinax punctulata Becc. in Webbia di U. Mart., II (1907), 280.

Figure 165. Thrinax drudei. a, fruit with the perianth as seen from below; b, seed; c, seed cut longitudinally through the embryo. From Wright No. 3965.

As it appears in the photograph (Plate 166) taken on the precipitous limestone cliffs of the forest-clad Mount Guanajay, this is a very elegant palm, which attains about forty feet of height, and has a straight cylindrical stem, marked by the usual approximate ring-like scars, and is terminated by a rather well furnished and elongate crown of leaves. The *leaves* have rather enlarged, elongate, ascendent bases, from which the long and slender petioles, sustaining the elegant radiately divided blades, rise in graceful curves. The dead leaves do not remain long to cover the trunk, which, except at its summit, is naked and of the uniform diameter of 7-8 cm. throughout. The base of the trunk has the same system of rootlets as in *T. wendlandiana.* The leaves have the divisions whitish on their lower surfaces, where they are, moreover, more densely dotted than in the other species, with small, ferrugineous, elliptical scales, and have 10-12 very slender, secondary nerves on each side of the midrib. The primary branches or partial inflorescences form rather dense ovoidal panicles, composed of slender flower-bearing branchlets, of which the lower and larger are 7-8 cm. long. The *flowers* are unknown. The *fruits* are quite sessile and very small, barely attaining 4 mm. in diameter. The *seed* is only 2.5 mm. in diameter and has the intrusion of the integument broadly conical, reaching to about the center of the albumen. (Figure 167).

Figure 166. Thrinax punctulata.

This species is known only from the specimens distributed by Van Hermann under n. 4245, collected on the same Mt. Guanajay in the Province Pinar del Rio, where the photograph was taken. The specimen bears only fruits and the flowers remain unknown.

As I have already pointed out (see under *T. drudei*) there is much resemblance between *T. punctulata* and *T. drudei* in general appearance, and it is necessary to obtain better specimens with flowers of both to establish these species on more sure diagnostic characters. Probably *T. drudei* is from the east of Cuba, as most of Wright's plants are, and *T. punctulata* is its representative form in the west part of the island.

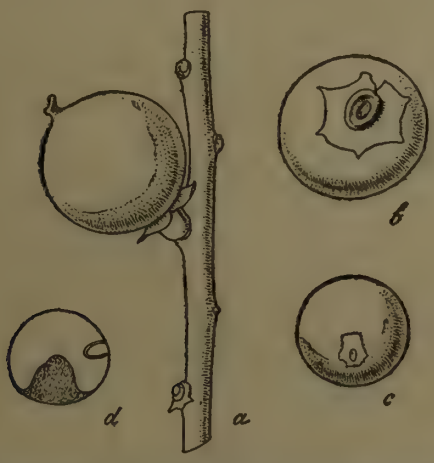

Figure 167. Thrinax punctulata. a, portion of a fruiting branchlet; b, fruit with the perianth as seen from behind; c, seed showing the hilum; d, seed cut longitudinally through the embryo. From Van Hermann No. 4745.

COCCOTHRINAX

Sargent in Bot. Gaz. XXVII (1899), 87; Becc. in Webbia di U. Mart., II (1907), 288. **Thrinax** (partim) auct. plur. **Thrincoma** O. F. Cook in Bull. Torrey Bot. Club, 1901, 539. **Tringhis** O. F. Cook l. c., 544.

A. Leaves of adult plants very deeply divided into a relatively few (25-30 at most) segments.

a. Leaves conspicuously silvery-white underneath, with very rigid radiating segments. Flowers more or less pedicellate. *C. miraguano*

aa. Leaves green on both surfaces. Flowers sessile. *C. rigida*

AA. Leaves having the blades entire in the center for at least the third part of the entire length, but usually more than that, and divided at the periphery into numerous (35-40) segments.

a. Leaves lustrous on the upper surface, and greyish or whitish on the lower.

b. Flowers with 12 stamens. Fruits more or less pedicellate on the lower part of the branchlets, almost sessile above. *C. martii*

bb. Flowers with 6-9 stamens. Fruits borne on a pedicel 3-5 mm. long. *C. acuminata*

aa. Leaves slightly ferrugineous (not silvery-white) on the lower surface, divisions strongly striately-veined on both surfaces. *C. crinita*

Coccothrinax miraguano Becc. in Webbia di U. Mart., II (1907), 295. **Thrinax? miraguano** Mart. Hist. nat. Palm. III, 320; Sauv. Fl. Cub. n. 2378.

This palm grows as isolated, scattered individuals in the plain at Cayamas in the Province of Santa Clara, apparently much deprived of its usual associates by the fires, which from time to time destroy the smaller vegetation of the savannahs. It is not a large palm, as it does not appear to surpass the height of 5-6 meters. The stem is cylindrical, probably not

Figure 168. Coccothrinax miraguano. a, portion of a flowering branchlet (the flowers are pedicellate); b, flower; c, fruiting perianth, as seen from above, after the fruit has been removed; d, fruiting perianth, as seen from behind; e, fruit; f, seed seen from above; g, seed, lower surface, in the center is the hilum; h, seed cut longitudinally through the embryo. From Wright No. 3221.

more than 15 cm. in diameter; it is crowned by brilliant, stiff, silvery leaves, but is clothed at the same time, perhaps during many years, with the dead ones, or, at least, it remains covered by half burnt vaginas of the leaf-stalks, when the blade has happened to be destroyed by fire. With time these stumps, also, fall off, and the base of the trunk remains for a certain distance above the soil naked and marked by approximate ring-like scars.

The expanded *leaves* of the full grown plant are of a very stiff texture, orbicular, divided into 20-25 or even 30 radiating segments of a beautiful

silvery-white on their lower surfaces. The *flowers* are small, have 8-9 stamens and are more or less pedicellate. The *fruit* is spherical, 8-9 mm. in diameter; the *seed* is 6.5-7 mm. in diameter and is marked by 4-5 vertical folds. (Figure 168).

This is one of the most peculiar, and at the same time one of the better known palms of Cuba, where apparently it is rather widely distributed (see Webbia l. c.). It grows also in the Isla de Pinos according to the specimens distributed by Curtiss (n. 423), but these specimens differ slightly from those of the larger island in having almost sessile flowers. (Figure 169).

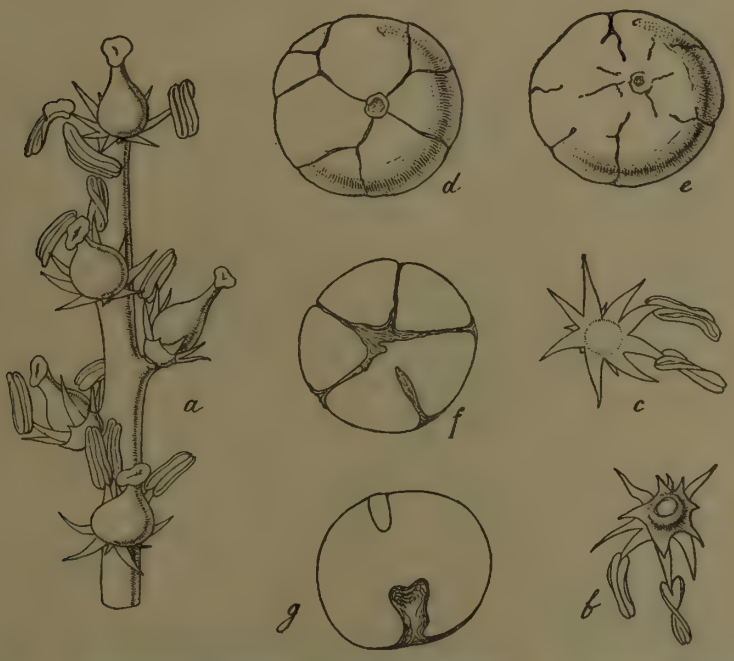

Figure 169. Coccothrinax miraguano (novo geronensis). a, portion of a flowering branchlet (the flowers are sessile); b, inner view of a flower, from which the ovary has been removed; c, flower seen from behind; d, seed, lower surface in the center is the hilum; e, seed, upper surface; f, seed, transverse section; g, longitudinal section of a seed through the embryo; in this section the albumen seems homogeneous, the cut not having severed any fold of the integument. From Curtiss No. 423.

Vernacular names: "Miraguano, Yuraguano, Guanichiche."

Coccothrinax rigida Becc. in Webbia di U. Mart., II, 299. **Thrinax rigida** Gris. et Wendl. in Gris. Cat. Pl. cub. 221; Sauv. Fl. Cub. n. 2377.

This is known only by the specimens distributed by Wright with n. 3220, probably collected in the east of the island.

It is evidently related to *C. miraguano*, but it is a smaller plant, the leaves have fewer, narrower, and less stiff divisions, and these are devoid of the beautiful silvery coating on the lower surface. The flowers are sessile; the fruits are unknown. (Figure 170).

Coccothrinax martii Becc. in Webbia di U. Mart., II (1907), 305. **Thrinax martii** Gris. et Wendl. in Gris. Cat. pl. Cub. 221 (partim?); Sauv. Fl. Cub. n. 2373 (partim?).

Collected only by Wright, probably in eastern end of the island, and distributed under n. 3219.

It is characterized by its *leaves* being rather deeply divided into numerous (about 38) segments, which are lustrous above and silvery-white underneath, by the *flowers* having 12 stamens, and by the *fruits* (7-8 mm. in diameter) borne on a pedicel 2 mm. long on the lower part of the branchlets, and sessile above; under the lens the surface of the fruit appears very finely punctulate-scabrid. (Figure 171).

Coccothrinax acuminata Sargent in Bot. Gaz., XXVII (1899), 89; Becc. in Webbia di U. Mart., II (1907), 313. **Thrinax acuminata** Gris. et Wendl. in Pl. Cub. Wrightianae n. 3966 (nomen in H. Kew.); Sauv. Fl. Cub. n. 2379; G. Maza, Nociones, etc. (1893), 51.

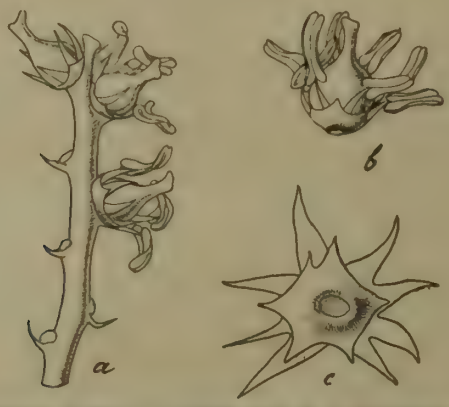

Figure 170. Coccothrinax rigida. a, upper end of a flowering branchlet; b, flower; c, perianth as seen from behind. From Wright No. 3220.

This is another of the palms discovered by Wright, probably in the east of Cuba; it has been distributed under the n. 3966. The specimens have no flowers, and bear fruits not thoroughly mature; these, however, are characteristic, as they are distinctly pedicellate (the pedicel is 3-5 mm. long) and not perfectly spherical, as in most species, but more or less distinctly globular-turbinate and apiculate, and have the surface finely and densely granulate. The leaves are silvery-white on the lower surface and are divided into about forty segments. Inside the fruiting perianth the remains of 6-9 stamens are distinguishable. (Figure 172).

Coccothrinax? crinita Becc. in Webbia di U. Mart., II (1907), 334. **Thrinax crinita** Gris. et Wendl. in Wright. Pl. Cub. n. 3967; Sauv. Fl. Cub. n. 2380.

I have doubtfully included this very imperfectly known palm in the genus *Coccothrinax,* as it has a general likeness to *C. argentea.* It differs,

however, from all the other Thrinax-like palms found in Cuba by its leaves, which are relatively large, divided into numerous segments (about 40) and not silvery underneath, but very faintly covered with a thin slightly rusty coating, which seems to vanish in the old leaves.

The specimens upon which the species is founded consist only of leaves and of portions of the fibrous net resting at the base of the petiole and composed of very fine brown filaments. This is perhaps another of the palms growing only in the east of the island.

Figure 171. Coccothrinax martii. a, portion of a flowering branchlet; b, flower, front view; c, flower as seen from behind; d, fruit; e, seed from a not quite mature fruit. From Wright No. 3219.

NOTE ON STEM THICKENING IN PALMS

It is now a very well established fact that the stem of several palms increases considerably in diameter, especially in its basal part, and this increase is said to be caused by a secondary growth, which, while it chiefly takes place in the fundamental parenchymatous tissue, is, also, in a small measure, developed by the formation of new fibro-vascular bundles.* I think, however, that the abnormal increase in diameter, or bulging, of the woody cylinder of certain palms in their intermediate, or upper part, which results in fusiform or clavate shaped trunks, is of a somewhat different nature from the more common form of thickening, observed in numerous palms, especially in those with a cocoid trunk.

*_Zodda:_ Sull'ispessimento dello stipite di alcune Palme, in "Malpighia" v. XVIII (1904), page 33.

Martius supposes that the peculiar structure of the fusiform or bulging trunks† may have originated in an increased number of leaves thrown out during a period of maximum vegetative activity of the plant, which subsequently and gradually decreased. This same explanation is accepted by Dr. J. W. Harshberger in his paper on the hour-glass stems of the Bermuda palmetto.‡ In this palm the stem frequently exhibits one or more waist-like constrictions, or hour-glass contractions, with interposed swellings, which are produced, according to this observer, by alternating periods of seasons favorable or prejudicial to the perfect growth of this palmetto. These periods are in direct correspondence with a larger or smaller crown of leaves, the larger diameters of the stem corresponding, of course, to the periods in which, as

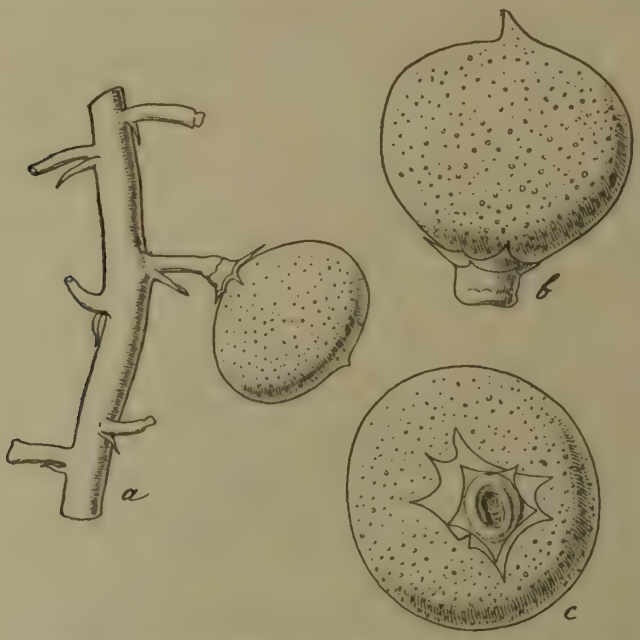

Figure 172. Coccothrinax acuminata. a, portion of a fruiting branchlet; b, fruit not thoroughly mature; c, the same fruit as seen from behind. From Wright No. 3966.

the more numerous leaves show, the vegetative forces are most active. The author adds, also, that "The increase is due to the expansion of the parenchymatous fundamental tissue, which separates the vascular bundles accompanied by an increase in the cell-cavity and by the increased thickening of the walls of the sclerenchymatous fibers which support the bundles."

If we take a special case of bulging, that for instance of *Pritchardia wrightii,* we may imagine that in youth the trunk for a certain time remains more or less cylindrical, probably on account of the uniform vegetative

†*Martius:* Hist. nat. Palm., v. III, page LXXXIV.
‡Proceedings of the Academy of Nat. Sc. of Philadelphia, 1905, page 701.

activity of its crown, but, when an increased production of leaves begins, it broadens gradually in its upper part, till the moment arrives at which the plant reaches and passes the maximum of its vegetative activity. The production of supernumerary leaves now gradually ceases, giving origin to the inverted phenomenon or the tapering of the trunk at its upper end. Such apparently is the process by which we may hold that the production of a fusiform or clavate trunk has been brought about. But the economic or utilitarian side of this contrivance consists, as I believe, in the building of a store house of reserve materials, to be utilized during the reproductive period of the plant, for it seems that the anomalous swelling decreases in size, when the plant begins to bear fruits. In this connection I have to observe that those palms with large and bulky trunks, as *Sagus, Jubaea, Washingtonia,* etc., have these of a soft pith-like texture in the interior, while their parenchymatous cells are filled with starch grains, especially in the period preceding the first emission of the spadices, that is, at the beginning of the reproductive period. We may, therefore, by analogy, suppose that the bulging of the trunk at a determinate period of the life of certain palms, may prove useful to them as magazines of reserve materials which accumulate there during the period of maximum vegetative activity of the plant, to supply the needful nutriment to the reproductive organs when the decrease in that activity shall set in.

The increase in diameter of the trunk in palms is certainly not a constant fact, for very many of them retain a trunk of unvarying thickness throughout their lifetime, as do those of an arundinaceous, calamoid or arecoid (cylindricus—Mohl.) type. But even where a general or local augmentation in thickness does take place, this is not always of the same nature; different causes must intervene both where there is a general increase throughout the entire trunk as in several palms of the cocoid type (*Jubaea, Washingtonia, Livistona,* etc.) or where only a bulbiform thickening takes place at the base (as in *Acantophoenix crinita, Latania commersonii, Hyophorbe commersonii,* etc.), or again where the increase is represented by a more or less pronounced partial bulging in the intermediate or upper part, as in *Iriartea ventricosa, Acrocomia fusiformis, Pritchardia wrightii, Hyphaene venticosa,* etc.

To better explain the difference between these different structures in the trunks of palms, I think that it will not be entirely useless to expound here, very briefly, my conception of the general structure of the trunk of a palm.

The primordial leaf of a palm, when fully developed and furnished at its base with a primordial root, produces from its axil a second leaf; this in its turn emits a second root which makes its way through the fundamental tissue of the corm-like base of the preceding or firstborn leaf, but externally and above the firstborn root. The progressive evolution of the entire plant is apparently a repetition of this phenomenon, from which it results that the more recently produced roots must be the more external, and that their

appearance must be in direct correspondence with the more internal, or last formed leaves.

According to these views we may suppose that in the vegetative cone of the trunk of a palm, the phenomena occurring in a primordial leaf are repeated as many times as there are leaves in the crown. The entire body of a palm should, therefore, be considered as a sympodium or an aggregate of several unities, each represented by one leaf furnished at its base with a vital node, from whence descend the fibro-vascular bundles, which ultimately end in corresponding roots.

The incipient fibro-vascular bundles descending from every newly formed leaf should, therefore, from the beginning, be considered as containing the elements of new roots and as corresponding to the first root issuing from the node of a primordial leaf. Such descending bundles, if they were not prevented by the continuous change of position of the leaves, as these gradually expand, would penetrate gradually and vertically the central part of the woody cylinder down to the roots; but as everybody knows, the new leaves are, during their expansion, gradually transported towards the periphery of the stem, and consequently the fibro-vascular bundles derived from the bases of these leaves are obliged to follow them, and to take the well-known course from the periphery towards the center of the woody cylinder, from whence they can freely descend throughout its entire length down to the base. Here, however, of necessity, the vascular bundles are forced to bend again towards the periphery, because they need to be organically connected in one way or another, with the roots. This connection, however, cannot be made with the old pre-existing roots, because these occupy the central part of the base of the trunk, and because every new emission of roots always takes place externally to and above the old ones.

Generally it is believed that the new roots originate quite independently of the vascular bundles of the central cylinder, but that a connection is established later between the bundles of the roots and those of the stem.* But my observations, however, confirm those of Meneghini†, who has demonstrated that in *Chamaerops humilis* "The fibro-vascular bundles of the roots are direct continuations of those descending from the leaves and more especially of those which being the last formed are peripheric;" and I will add that the point of emission of a new root is, in consequence, pre-established by the position of its corresponding leaf. To strengthen this opinion I would remark that, in cultivated palms, there is always a correlation between certain leaves and certain determinate roots, so that if a root be injured by disease, or is killed by other cause, the corresponding leaf also shows signs of decay, and vice-versa. It may, also, be observed that a new root can never originate in direct correspondence to an old or dead leaf.

Drabble: On the Anatomy of the Roots of Palms, in Trans. Linn. Soc. London 2d Ser. VI (1904), Botany, page 443.

†*Meneghini:* Ricerche sulla struttura del caule delle piante Monocotiledoni (1836), page 101, tab. VII. 6.

This is proved by the fact that when a palm loses its central shoot no new roots make their appearance, although the more external leaves may remain alive and retain their functional activity for several years afterwards.

From what I have observed, the new emission of roots happens only when the newly formed leaves begin to expand. This exposition of the mode in which new roots in palms are emitted, is corroborated by what takes place when, for example, we desire, for horticultural purposes, to transplant a palm (a *Phoenix* or a *Cocos,* for instance). We are then obliged to cut away the greater part of its roots, and also the older, but not yet quite functionless, leaves. We can then see that the new roots make their way externally to and above the old ones, on the periphery and at the base of the trunk, as soon as the newly formed leaves begin to expand.

From all I have now said, it seems to me certain that a correlation exists between the emission of new leaves and that of new roots. This parallelism apparently exists, also, in the number, form, and disposition of the vascular bundles of the roots, and in the form, number, and disposition of the primary nerves in the primordial leaves. The existence, therefore, of an uninterrupted continuity between the vascular bundles descending from the leaves and the new roots, appears extremely probable; it is, indeed, an unavoidable consequence of the necessity of a physiological connection between the hypogean and the aerial system.

The result of this continuity of the vascular bundles descending from the new leaves down to the base of the trunk is that we find at every new vegetative period an increased number of newly formed vascular bundles; these must not, however, be regarded as elements of secondary growths, but as true primary formations striving to intercalate themselves among the pre-existing vascular elements. An interstitial augmentation of the number of vascular bundles thus takes place, which in the case of those palms whose stems are unable to distend their outer or cortical coatings (arecoid, arundinaceous, calamoid trunks) increase their internal solidity; while those trunks whose tissues are of a soft nature and which, on account of the loose structure of the peripherous parts of their woody cylinders, are susceptible of distension, (which is especially the case in palms of the cocoid type), will increase in girth. In this latter kind of trunks even the fundamental parenchymatous tissue may find room for cellular multiplication. If, therefore, in any transverse section of the lower and thickened part of a palm stem new, young, vascular bundles occur, I am inclined to suppose that this fact is not to be attributed to a neoformation process, but to an extension in length or to a division of the new bundles derived from the nearly expanded leaves in their tendency to produce new roots. Of these bundles, perhaps only a portion reaches the base of the trunk to produce bulbous enlargements and cause the emission of new roots there; other portions may be arrested at different levels and contribute only to the solidity of the woody cylinder; or, at times and under certain circumstances, they may force their way

outward, appearing as adventitious roots; for it seems that the entire mass of the vascular bundles of recent formation is endowed with a latent potentiality of producing adventitious roots, whenever a portion of it is able, under favorable conditions of ambient, to pierce an opening through the external cylinder. This is what happens in those palms which produce large masses of adventitious roots in the epigeous parts of their trunks, for instance, in *Thrinax wendlandiana* and, more especially, in *Gaussia princeps* among the Cuban palms, and, also, among the palms cultivated in our country, viz., *Washingtonia, Phoenix dactylifera*, etc., when they meet with suitable conditions of temperature and moisture.

From the observations made above I am led to conclude, that the bulging of the stem in palms is due to the same ordinary processes which cause the lengthening of the vegetative cone in the normally developed stems, and it apparently depends, not upon a secondary growth of the already formed elements, but, while it is partly due to the greater number of fibro-vascular bundles produced (and, also, perhaps, to the greater diameter of their elements), yet, in a still greater measure, it is the effect of the greater diameter of the cells composing the fundamental tissue and of the larger intercellular spaces, the increased diameter of the cells being obviously caused by the accumulation in their interiors of a large quantity of starch grains, or of nutritive fluids, all of which are due to the increased vegetative activity of the plant, in the moment that precedes the beginning of the reproductive period.

This was, also, the opinion of Martius, who, speaking of the fusiform stem of *Iriartea ventricosa* (vol. III p. LXXXV), writes that the swelling is produced, not so much by an increase in thickness of the wood, but principally by the more abundant and more lax parenchymatous tissue. While greatly regretting that he had been unable to analyse the trunk of the said palm, when he had the opportunity of doing so, he reproduces a manuscript note of Plumier on the swollen trunk of *Euterpe? vinifera* (*Pseudophoenix vinifera* Becc.). Of this palm Plumier says that at the point where the upper portion of the inflated part begins to taper (corresponding to the period in which the plant is about to produce fruit for the first time), the tissues of the inflated part are soft and pulpy and contain a great quantity of a very sweet juice, from which, by fermentation, a kind of wine is made. The pith-like parenchymatous substance of the interior of the swelling must be very soft and the juice it contains very abundant, as this latter is obtained simply by squeezing the parenchymatous tissue between the hands, after it has been reduced to a paste by repeated beatings with a pestle,*

*Of *Iriartea ventricosa* Mart. writes, (v. III, page LXXXV): Quaenam sit in illa parte tumida ligni compages, qui fibrarum decursus et quae ad materiem cellulosam ratio, examinare, dum in palmae patria commorabar, quod valde doleo, neglexi, attamen mihi persuadeo, in illo caudicis fuso materiem ligni nec frequentiorem, nec spissiorem esse, immo parenchyma, fibris percursum, interiora laxius quam in reliquo caudice replere.

And of the *Euterpe? vinifera* (*Pseudophoenix*) it is said (l. c. p. LXXXVI.): Constat vero haec singularis caudicis struma e substantia omogenea, medullosa, fructu Melonis

When the swelling of a fusiform trunk has attained a certain diameter, it probably remains unchanged for the lifetime of the plant. I can, however, produce no personal observations on the subject. Certainly the same cannot be asserted of the bulbous bases of some arecoid trunks, as those mentioned above, nor even of the entire lower portions of others of the cocoid type, for in both cases an increase in diameter has been unquestionably ascertained by numerous observers. I have myself perceived by careful measurements the increase in bulk of the stem of a *Jubaea spectabilis* cultivated in my garden near Florence. This I measured in the year 1906 on behalf of Prof. Strasburger* and ascertained that it, at that time, was 3 m. 30 cm. in girth at about 10 cm. above the ground, whereas, in August, 1911, it had increased to 3 m. 71 cm.

In such a kind of trunk the augmentation in diameter may be correctly attributed, in a great measure at least, to a secondary merismatic multiplication of the fundamental tissue; but still more, I think, to the interlocation between the pre-existing elements, of a large number of fibro-vascular bundles descending from the vegetative cone at every emission of new leaves.

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spissiore et fluido scatet saccharino, quod sapore eum dulcissimo liquore Coci nuciferae immo interdum cum succo expresso Arundinis sacchariferae potest comparari, atque a venitoribus pro extinguenda siti bibitur.

*Ueber die Verdickungsweise der Staemme von Palmen, in "Jahrbüch. für wiss. Bot." XLIII. 4, page 607.

The Propagation of the Date

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The propagation of the edible date in the arid, southwestern regions of the United States is an industry that has but recently been put upon a commercial basis, although the United States Department of Agriculture made its first importation of date palms about twenty-five years ago. The area in which this palm will thrive and mature fruit is necessarily limited in this country because of the intense heat that is required for the several months preceding and during the ripening of the crop; so that the industry seems now to be confined to a few localities such as the Colorado Desert region, the Chuckawalla country and Palo Verde mesa, the Imperial Valley, Yuma, Arizona, and regions about Phoenix and the Salt River Valley. The results obtained from seedlings and imported plants tested in these regions have been so satisfactory and highly profitable that private companies and individuals have gone into the rearing and growing of dates on a sufficiently large scale to eliminate doubt as to the future magnitude of the industry. They are already beginning to propagate their own plants. And this phase of date growing will naturally increase as the orchards from which propagating material can be drawn, increase.

If propagation is attempted from seeds, about one-half of the seedling plants will be male palms and practically valueless; for the male palm does not bear fruit. And since one male palm will suffice to pollinate the flower clusters of an acre of female plants, it becomes necessary to destroy about forty-nine out of every fifty of these male plants that have required months of care and attention before their sex could be determined. This method is, therefore, obviously wasteful and expensive. On the other hand, of the possible forty or fifty female palms that will be obtainable from a hundred seedlings, there may be but three or four, and sometimes only one, that is of a quality sufficiently fine to make it worthy of consideration for commercial purposes. (Opinion varies so that no definite number can be given. Some claim that as high as ten per cent. of the females will produce good fruit). All of the remaining female plants bear fruit that is of a quality inferior to this and of as many different characteristics as there are different seedlings from which to pick fruit, since the seedling date sports very decidedly, this tendency varying in degree somewhat with the variety of seeds planted. It is thus seen that from a possible hundred seeds, but a very few palms bear desirable fruit; and these would very probably be so different in flavor, color, size and other characteristics that they could not be standardized as com-

*Mr. Cornell has spent some considerable time among the date orchards of Southern California during the last two years.

mercial varieties unless there were some way in which a variety could be perpetuated. This way is evidently not from growing seedlings.

Palm off-shoots are small suckers which grow from the sides and around the bases of the larger palms; and it is from these off-shoots that all standard varieties of commercial dates are grown, since they will root and grow into palms that bear fruit identical with that of the parent plants. The Arabs have known this fact for generations and have thus established many distinct varieties that can be found in abundance in the old date growing regions

Plate 173. This illustrates the way in which the off-shoots are unloaded at the nursery, after being dipped and hauled from the station. They sometimes lie for two days before being planted.

around the Persian Gulf and the Algerian deserts. They think of growing date palms in no other way and will carry off-shoots of a choice variety on camel back, for a journey of days, to plant them in their own gardens. And, thus, the problem of establishing and maintaining standard commercial varieties has been solved most satisfactorily.

As the date palm is not indigenous to America, the question of introducing and establishing it here, presented a rather difficult problem, since it was necessary to import these off-shoots from half way around the globe. The United States Department of Agriculture was the first to bring in

plants; and the impetus gained from their small importation of a quarter century ago, has been such that one private concern, alone, imported 15,000 off-shoots, in the summer of 1913, for commercial planting in and about the Colorado Desert. These shoots, which weigh anywhere from ten to fifty pounds, are severed from the parent tree by means of heavy chisels made especially for the purpose. After painting the severed butt-ends of the shoots, their tops are trimmed and the whole plant is wrapped and sewed in a covering of palm fiber or burlap, preparatory to shipment. They are

Plate 174. There are about 15,000 off-shoots in this one nursery field in which the planters are still at work. The young palms are leaned slightly toward the prevailing wind, because it is thought that they will thus grow straighter; the rows are four feet apart, with the plants three feet apart in the rows.

frequently packed in boxes to facilitate handling on their long journey during which they must be kept sufficiently moist to prevent excessive drying, but not so damp as to encourage mould or rot. At the end of their journey, the Department of Agriculture requires that they be immersed for two different periods of fifteen minutes each in an insecticide of given formula that is a guaranteed "kill-all-but-the-plant." They must then be planted in nursery form in an isolated place at least one thousand feet from any other date palms where they have to serve a year's sentence of quarantine

before being admitted as bona fide citizens to the date world of the United States.

After being thus rudely torn from the side of the parent plant to make a ninety day journey over land and sea, at the end of which they are given a half hour bath in a solution strong enough to kill all animal parasites, these young date palms are hauled to their new home where the rooting process is to take place. Here, they are unloaded on the ground and lie in the burning heat, sometimes for two days, before they are set in the ground and watered. This exposure to the dry air and intense heat tends to dry them thoroughly and stop any fungous growth that may have started,

Plate 175. This photograph shows a bed of seed flats ready to receive the seeds; the boxes have been sunk in the ground and filled with soil; after planting and covering, the bed can be easily flooded with water from the ditch. A fair idea may here be gained of the barrenness of the desert. The darkest clumps are mesquite; the low growing, lighter colored clumps are salt bush, grease-wood, etc.

as well as to reduce the danger to the palms of rotting after they have been planted. Thus far, the shoots seem to have been indifferent to much harsh treatment; but after planting in the nursery rows, they demand skilled and systematic attention. They must be kept continually moist and are generally watered every other day for the first six weeks. After this time, the fre-

quency of the irrigations may be gradually diminished as the young shoots establish themselves in their new home; but the plants should never be allowed to approach a state of dryness. During the first few weeks that the roots are starting, it is considered fatal to the life of the palm to disturb its position in the least, an idea that has grown to be almost a superstition with some who claim that the slightest jar to the plant during this period will injure the new roots and kill the palm. Undoubtedly the rooting process is slow and laborious, it being a not uncommon thing for an off-shoot to lie dormant for a whole year before evidencing any signs of life, though most of the shoots will be well rooted at the end of eight or nine months. The percentage which lives varies with the variety of the date, with the condition of the plants upon their arrival, and with the treatment which they receive in the nursery; but the rooting has been generally successful.

Although the commercial date must be propagated from off-shoots, as previously stated, it sometimes becomes desirable to grow seedlings for a windbreak, or from which to experiment on new varieties. It is because of the tendency of the date to sport that new fruits can be obtained from seedlings, very few of which may be far superior to their parent kind. Although it is generally a slow and unsatisfactory method of establishing an orchard, to plant seedlings and go through the long and expensive process of selection and elimination, if one is so fortunate as to draw a prize plant out of a possible hundred or thousand seedlings, he may be well repaid for his pains; for all new varieties must originate from seedlings. This choice seedling can be encouraged to produce off-shoots and by their propagation, one could in time establish this new variety to the ultimate good of the date industry.

And so it is that a word on the growing of the seedling may not be amiss. It is generally thought that while the date does not come true to seed, there is, nevertheless, a slight tendency of the offspring to resemble somewhat its parent type; so that, in planting seeds, it seems wise to select them from choice fruits. These are generally soaked in warm water for about a week before being planted, to hasten their germination. They may then be planted in seed flats or in the open ground according to the convenience at the time. However, planting in boxes makes easier the subsequent handling. In any event, soil should not be used, that contains sufficient alkali to injure an ordinary field crop. The seeds should be covered to a depth of one or two inches at a distance of three or four inches apart, after which it is largely a matter of keeping them watered. When a few inches high, they are set out in rows where they can be cared for till old enough to show their sex, if they are desired for selective purposes, and should be given enough room not to crowd for at least four years, when the sex of most of the plants will have been determined.

When off-shoots have become well rooted, or when these seedlings have thus been sorted, they are ready for orchard form, where about fifty palms

are set to the acre. If well favored by sufficient irrigation, cultivation and intense heat, these young plants will begin to bear in three or four years from the seed or off-shoot. By ten years, they will attain a maximum capacity of fruiting which will endure throughout the life of the palm. The date is known to grow and bear fruit for at least a century. When it has thus become established in orchards of the southwest, offshoots will be produced in sufficient abundance to forego the necessity of importing them from abroad; and their propagation will be made possible at much less cost and with a greater degree of certainty than now exists.

Imported Varieties of the Avocado for California

K. A. RYERSON
ASSOCIATE EDITOR UNIVERSITY OF CALIFORNIA JOURNAL OF AGRICULTURE

In the development of so promising a commercial enterprise as the culture of the avocado has proved to be, naturally the question of the most suitable varieties is paramount. During the past two or three years, there have appeared many varieties, originating locally, some of which lack little of being classed as ideal commercial fruits. However, no matter how well adapted to the demands of the market these varieties may be, there is still room for improvement. The season in which avocados may be secured at a reasonable cost needs to be lengthened; we now have varieties that give us fruits almost continuously throughout the year but the quantity is limited.

The extension of avocado growing into the cooler parts of California depends on the securing of the hardiest types, and this requires the careful exploration of the native avocado districts of the world. But little has been done in this line as yet; we do not know what possibilities lie undiscovered in the highlands of Mexico, Central and South America. Mexico has received the most attention so far. The grower, in the end, will not be satisfied until he has the very best that the world affords. The first steps in this direction have been made for the most part by private concerns, the government having attempted little thus far. The first explorations have greatly increased our number of commercial varieties and have added much to the length of the season in which avocados will be able to be obtained reasonably and plentifully.

It is a recognized fact that the fruit intended to be placed on the eastern market must be of the thick skinned type in order to withstand shipment without great loss. Also, in order to compete on an equal footing with the Florida avocado, this type will have to be adhered to. We can not expect a profitable return unless the California product is equal to or better than that of its competitor. The thin skinned type is admirably suited to the local market and to growing for home use, since it is, as a rule, very prolific and somewhat hardier than many of the larger thick skinned fruits in our list at present. Nevertheless, it is not reasonable to conclude that if a choice variety is somewhat more tender than a more inferior variety, the latter should be planted in preference. If it is profitable to protect an orange grove from the ravages of the cold, how much more reasonable to protect fruit yielding far greater returns than the orange.

It is to the highlands of Mexico, Central and South America that we must look for new varieties of the avocado, that will be suitable to our climatic conditions. Because a variety is rated as a Mexican or Central or

✓ Plate 176. Fruit of Ideal, about seven-eighths natural size.

South American variety, it does not follow that it will be adapted to our conditions. All conditions of climate are found in these regions, from those of the torrid tropical lowlands to those at the altitude of perpetual snows. The regions from which the greater majority of our new introductions have come are the highlands of Mexico ranging from about four thousand five hundred to eight thousand feet in altitude; notably Atlixco, 7000 feet; Queretaro, 6000 feet; Guanajuato, 6800 feet; and Guadalajara, 5400 feet. The climatic conditions of these regions are strikingly similar to those of much of California; in parts the rainfall is even less than that which most of Southern California enjoys. Much, then, is to be expected from fruits of these districts. Practically the whole of Central and South America remains to be explored. Travelers report types and varieties of the avocado at the present time unknown to our horticulture. No one can accurately predict the extent to which this fruit may be cultivated in the future.

The importation of the avocado from these regions south of the United States has been successfully done by three parties in Southern California,—Mr. D. E. Clower of Monrovia, Mr. A. R. Rideout of Whittier, and the West India Gardens of Altadena.

One hears and reads of the so-called imported varieties without knowing just what has been accomplished along that line, and it is in order to show the extent of this work, that the following list is presented. It gives as completely as possible those varieties that have been imported up to the present time. Wherever possible the complete pomological description is given, but this is manifestly impossible in all cases, as the material is not available. When all have fruited in this country, there may be some variation from the parent type. However, all conditions are so similar to those of its native home that it is doubtful if there will be much deviation from type or from the time of the fruiting season.

The following three varieties were introduced by D. E. Clower of Monrovia, California, from Mexico and South America. He has also several several other varieties under trial.

IDEAL

Description: Form, pyriform; size, large; dimensions, length, seven, diameter, four and one-half inches; weight, one and one-half pounds; surface, rough; color, green; skin, thick and hard, separating readily from the flesh; flesh, rich, creamy yellow; texture, smooth and oily; fibre, none; flavor, very fine; quality, first; seed, small, tight in cavity; season, March to June. Mexico.

TWO POUND GREEN

Description: Form, pyriform; size, very large; dimensions, length seven and one-half, diameter four and three-quarters inches; weight, two pounds; surface, rough; color, green; skin, thick and tough, separating readily from

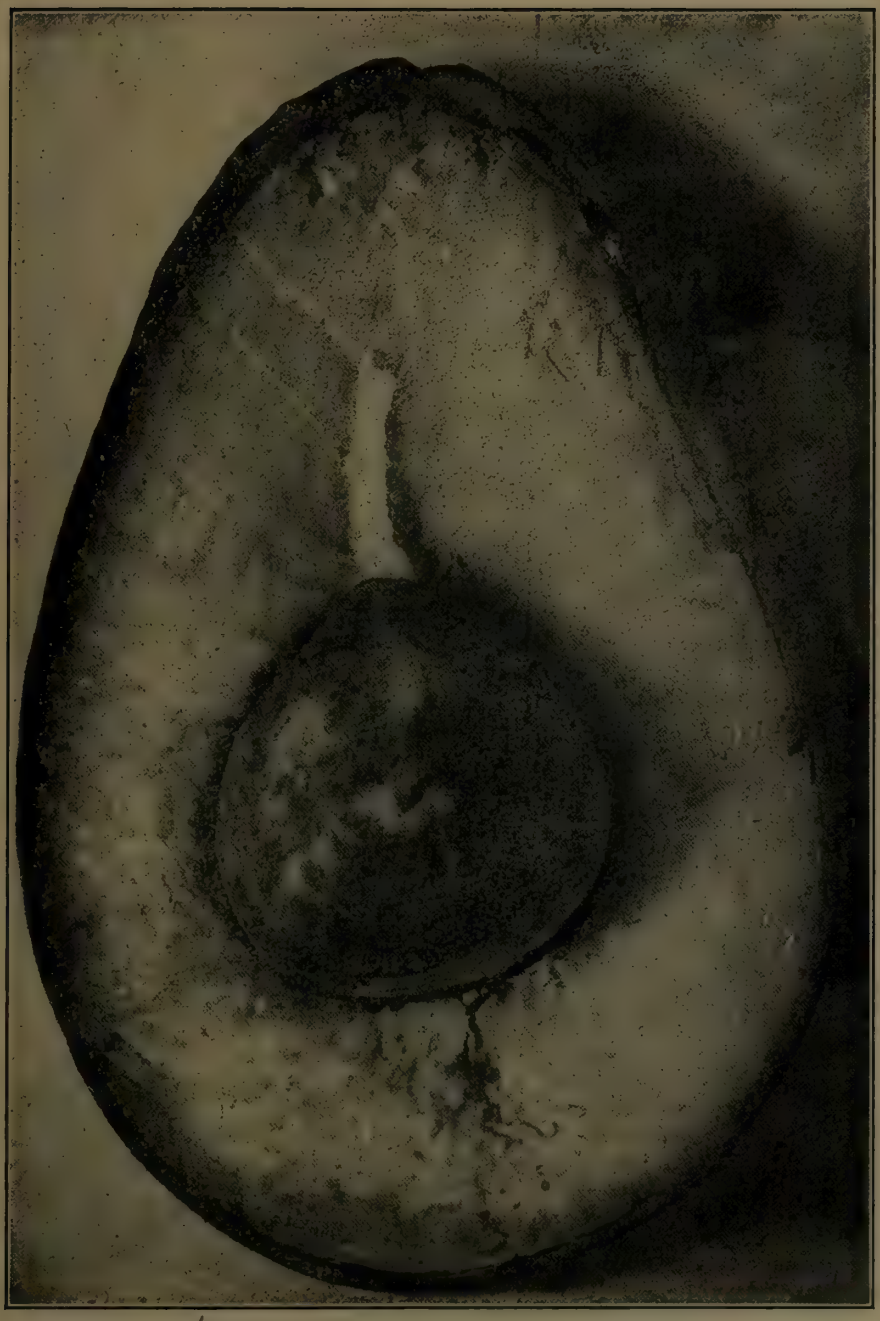

Plate 177. Ideal, in section, about natural size.

the flesh; flesh, creamy yellow; texture, very oily; fibre, none; flavor, very rich and pleasant; quality, first; seed, small, tight in cavity; season, March to June. Mexico.

CHILI

Description: Form, pyriform; size, medium; weight, twelve ounces; color, green; skin, thick and tough, separating readily from the flesh; flesh, creamy yellow; texture, smooth and very oily; fibre, none; flavor, rich and nutty; quality, very good; seed, small, tight in cavity; season, June in Chili.

The parent tree of this variety is growing at an altitude in Chili where twelve inches of snow is said to fall, showing it to be one of the hardiest of varieties. The leaves possess the anise odor peculiar almost exclusively to the small, thin-skinned Mexican varieties. The commercial qualities of this fruit are said to be such that it commands a price on the Chilean market that would be considered very high even in this country, despite the fact that the common small, thin-skinned varieties are selling on the same market at three for five cents. The season in Chili is just the reverse of ours so that it will probably ripen its fruit in June in this country.

WEST INDIA GARDENS IMPORTATIONS

NUMBER SEVEN

One of the trees that proved to be most hardy in the California freeze of 1912-13 is that known as Number Seven, it being untouched even in its exposed position in the open ground with a temperature of 16 degrees. It was introduced from San Sebastian, Queretaro, Mexico, at an altitude of between five and six thousand feet. The fruit is of an excellent quality.

Description: Form, oval; size, medium to large; dimensions, length six, diameter, two and one-half inches; weight, three quarters to one pound; skin, thick, separating readily from the flesh; color, black; flesh, yellow shading to green near the skin; flavor and quality, very good; seed, medium, tight in cavity; season, March at San Sebastian, Queretaro.

NUMBER NINE

Description: Form, oval to pyriform; size, large; color, black; skin, thick, separating from the flesh; flesh, medium yellow, tinged greenish near the skin; seed, medium, tight in cavity; season, July and August at Canada, Queretaro.

QUERETARO (NUMBER ELEVEN)

The Queretaro is one of the very prolific varieties, and the young trees now growing here seem to flourish well.

Description: Form, oval; size, medium large; dimensions, length, five, diameter, three inches; surface, rough; color, black; skin, thick and tough; flesh, medium yellow, separating readily from the skin; flavor, extra fine;

quality, good to very good; seed, medium small, tight in cavity; season, August to October at Canada, Queretaro.

PUEBLA (NUMBER THIRTEEN)

Description: Form, pyriform, not necked; size, medium; dimensions, length, four, diameter, three inches; surface, smooth; color, purple; skin, thick and tough, separating readily from the flesh; flesh, yellow, greenish towards skin; flavor, fine; quality, good; seed, small, tight in cavity; season, September and October at Atlixco, Mexico.

Plate 178. No. 7. Budded trees 1 year 10 months from bud; 1 year old stock.

NUMBER FIFTEEN

Young trees of this variety are doing well at the present time in California, and it promises to be one of the best medium sized fruits in a commercial way. It is of good shape for packing and shipping and of extra fine quality.

Description: Form, oval; size, medium; dimensions, length, four, diameter, three inches; surface, somewhat rough; color, green; skin, thick, separating readily from the flesh; flesh, yellow, smooth and buttery; flavor, rich; quality, very good; seed, small, tight in cavity; season, October and November at Atlixco, Puebla.

REDONDO (NUMBER SIXTEEN)

Several round varieties have been imported among the other types and these have a special advantage over the others in that they are able to be packed better and grade much more uniformly. When shipped for any great distance they are much less liable to injury in transit. The tree from which this variety was derived is over a hundred years old and is forty feet high.

Description: Form, round; size, medium; dimensions, length, three and one-quarter, diameter, three and one-quarter inches; weight, three-quarters of a pound; apex, slightly flattened; base, round; surface, somewhat rough;

Plate 179. Redondo No. 16.

color, dark green with fairly numerous, small, yellowish, irregular, subcutaneous dots; skin, very thick, hard and tough, separating readily from the flesh; flesh, cream color, shading to greenish near the skin; texture, smooth and buttery; fibre, none; flavor, rich, nutty and delicious; quality, very excellent; seed, small, round-conical, tight in cavity; season, November and December at Atlixco, Puebla.

CALIFORNIA TRAPP (NUMBER SEVENTEEN)

The variety known as the Trapp is the leading Florida fruit in the eastern markets. It is an extremely popular fruit and comes at a season when it can command the fanciest prices, i. e., from October first to January

first. In California, however, this variety has failed to thrive thus far, though many attempts have been made to establish it here. From Atlixco now comes a variety that very closely resembles the Florida fruit in size, shape, and season and it is of the first quality. It is well suited for extensive orchard plantings and is well adapted to the climate of this state.

Description: Form, roundish, slightly oblique, cross section, very slightly scalloped; size, large; dimensions, length, five and one-quarter, width, four and three-quarters inches; weight, twenty-two ounces; base, very slightly tapering, insertion slightly one-sided; apex, flattened slightly; stem, stout;

Plate 180. California Trapp No. 17.

surface, fairly smooth; color, medium green with few, small to large irregular raised russet dots; skin, very thick, tough and hard, separating readily from the flesh; flesh, cream color, greenish near skin; texture, smooth and buttery; fibre, almost none; flavor, mild, rich and nutty; quality, first; seed, medium, oblate, tight in cavity; season, December and January at Atlixco, Puebla.

NUMBER EIGHTEEN

Description: Form, long pyriform, sometimes slightly curved; size, medium large; dimensions, length, six and one-quarter, diameter, three and one-half inches; weight, about one pound; base, tapering, rather narrow; apex, rounded; stem, stout; surface, somewhat rough; color, purple with

fairly numerous, rounded, small, yellowish dots; skin, thick, tough and hard, separating readily from the flesh; flesh, light cream, tinged green near skin; texture, smooth; fibre, none; flavor, mild, nutty and delicious; quality, first; seed, medium, slender, conical, tight in cavity; season, December and January at Atlixco, Puebla.

NUMBER NINETEEN

Few varieties can equal this one in the unusually high proportion of meat to seed. It ranks among the very first of all discovered thus far. It

Plate 181. No. 19.

is very large and has a tough skin, making it a good shipper. It should prove a prime favorite for hotel trade, one fruit making a salad sufficient for six persons.

Description: Form, slender pyriform; size, very large; dimensions, length, seven, diameter, four and one-quarter inches; weight, one and three-quarters pounds; base, broad, tapering somewhat; apex, round; surface, undulating, slightly rough; color, dark green with a number of medium sized, irregular, indented russet dots; skin, thick, hard and tough, separating readily from the flesh; flesh, cream, slightly greenish near skin; texture, smooth and buttery; fibre, none; flavor, rich, buttery and delicious; quality, extra good; seed, small to medium, conical, tight in cavity; season, January at Atlixco, Queretaro.

NUMBER TWENTY-FIVE

Description: Form, round to pyriform; size, medium to large; dimensions, length, five, diameter, three and one-half inches; weight, one pound; apex, slightly oblique, flattened; stem, stout; surface, slightly roughened; color, yellowish green with numerous, medium sized, irregular, subcutaneous, yellowish dots; skin, thick, tough and hard, separating readily from the flesh; flesh, cream, tinged green near skin; texture, very smooth and buttery; fibre, none; flavor, mild and very pleasant; quality, excellent; seed, very small, conical, tight in cavity; season, January at Atlixco, Queretaro.

NUMBER TWENTY-EIGHT

Description: Form, round-oval to pyriform; size, large; dimensions, length, six and one-half, diameter, four inches; weight, one and one-quarter pounds; base, tapering somewhat; apex, slightly flattened or depressed; stem, stout; surface, rough, slightly undulating; color, deep dark green with numerous small to medium sized irregular, subcutaneous, greenish yellow dots; skin, thick, hard and tough, separating readily from the flesh; flesh, deep creamy yellow, turning green near skin; texture, smooth and buttery; fibre, none; flavor, rich, mild and nutty; quality, very good; seed, small, conical, and tight in cavity; season, November to January at Atlixco, Puebla.

ATLIXCO (NUMBER TWENTY-NINE)

Description: Form, oblong to obliquely pyriform; size, medium large; dimensions, length, five, diameter, three and three-quarters inches; weight, one pound; base, oblique, flattened slightly; stem cavity, very shallow, narrow, flaring and plaited; apex, flattened, slightly concave; stem, stout; surface, slightly rough; color, greenish purple with numerous, small, irregular, subcutaneous yellowish dots; skin, thick, tough, not brittle, separating fairly readily from the flesh; flesh, light cream, tinged green near skin; texture, smooth, fine; fiber, none; flavor, good, nutty, mild; quality, good; seed, medium to large, oblong-conical, tight in cavity; season, December at Atlixco, Puebla.

NUMBER THIRTY-TWO

Description: Form, slender pyriform; size, medium large; dimensions, length, six and one-half, diameter, three and one-half inches; weight, one and one-eighth pounds; base, tapering, broadly blunt; stem cavity, medium in width, shallow, flaring and creased with russet markings; apex, slightly flattened, point indistinguishable; stem, stout; surface, undulating, slightly warty in spots; color, glossy green with small, irregular, raised, russet dots often in patches; skin, very thick, hard and granular, separating readily from the flesh; flesh, deep cream, greenish near skin; texture, smooth; fiber, none; flavor, mild and pleasant; quality, good; seed, very small, conical, tight in cavity; season, December to February at Atlixco, Puebla.

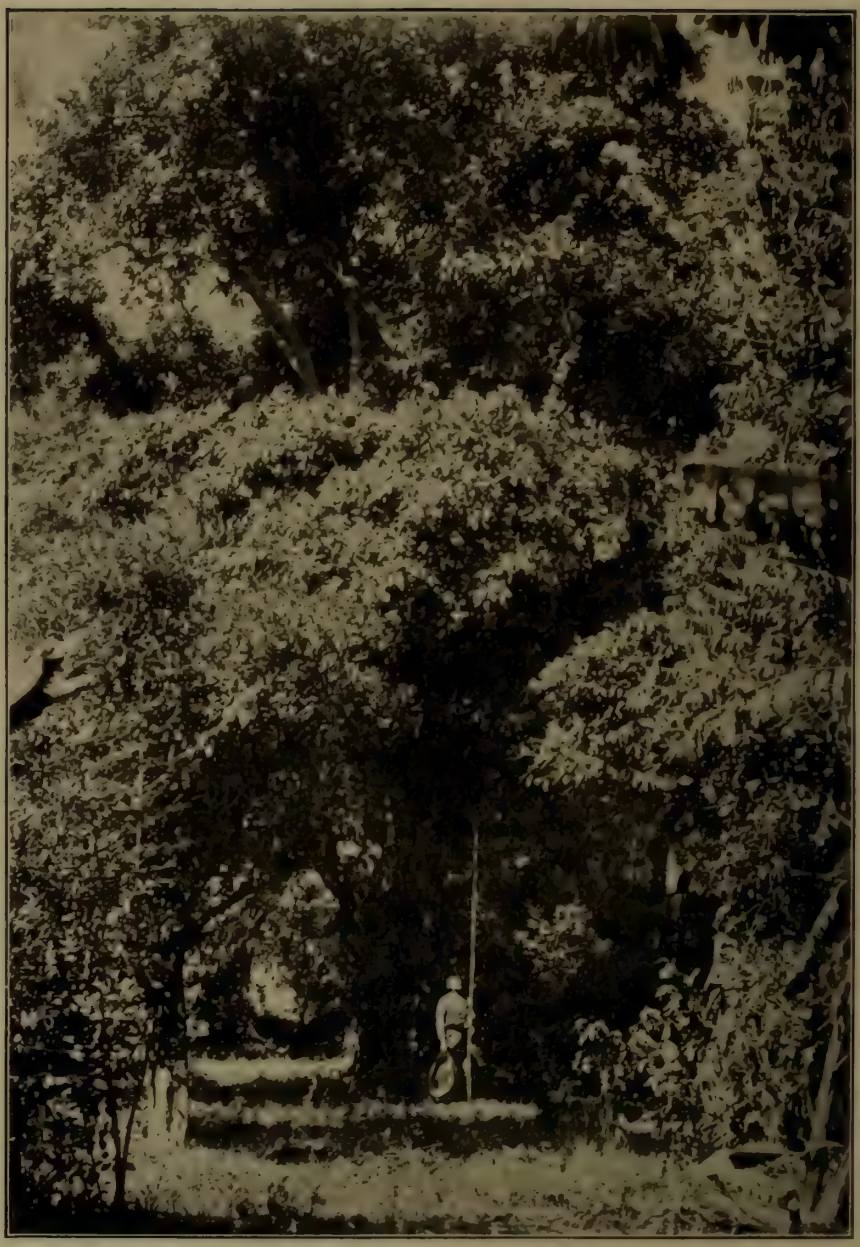

Plate 182. Montezuma Tree No. 33.

MONTEZUMA (NUMBER THIRTY-THREE)

Description: Form, broad pyriform, almost egg-shaped; size, medium large; dimensions, length, four and one-half, diameter, three and one-half inches; weight, fourteen ounces to one pound; base, tapering slightly to stem; apex, very slightly depressed; surface, slightly undulating; color, deep green with few, round, raised, irregular, russet dots, sometimes in the form of patches; skin, thick, granular and hard, separating readily from the flesh; flesh, deep cream; texture, smooth; fiber, none; flavor, mild and pleasant; quality, good; seed, medium, oblate-conical, tight in cavity; season, December to February at Atlixco, Puebla.

Plate 183. Montezuma Fruit No. 33.

SINALOA (NUMBER THIRTY-SEVEN)

This variety is not to be confused with the one described under the same name in this publication, Vol. 1, No. 1, February 1911, page 16, by F. W. Popenoe. This latter variety is no longer existing and the name has been transferred to the variety described below. This variety is one of the very desirable commercial introductions, being a large fruit of excellent flavor and smooth texture, and coming into maturity at the most favorable season of the year.

Description: Form, oval to pyriform; size, medium large; dimensions, length, seven, diameter, five inches; weight, one and one-half to two pounds;

base, slightly tapering; apex, rounded; stem, stout; surface, rough; color, green with numerous, medium sized, raised, irregular, yellowish dots; skin, thick and tough, separating readily from the flesh; flesh, deep cream, tinged green near skin; texture, smooth and buttery; fiber, none; flavor, rich and pleasing; quality, excellent; seed, medium, round-conical, tight in cavity; season, December to March at Atlixco, Puebla.

Plate 184. Sinaloa No. 37. A fine, large fruit from Atlixco, Mexico.

NUMBER THIRTY-EIGHT

Description: Form, pyriform; size, medium large; dimensions, length, five and three-quarters, diameter, three and three-quarters inches; weight, one and one-quarter to one and one-half pounds; base, slightly flattened; insertion, slightly one-sided; apex, rounded, slightly depressed; surface, rough; color, dark green with rather numerous, irregular, medium sized yellowish dots; skin, thick and tough, separating readily from the flesh; flesh, deep cream, turning to greenish near the skin; texture, smooth; fiber, none; flavor, mild and rich; quality, very good; seed, medium, round-conical, tight in cavity; season, December at Atlixco, Puebla.

NUMBER THIRTY-NINE

This is one of the large types of the finest quality, a royal fruit where this type is desired, especially suited for hotel and similar trade.

Description: Form, pyriform; size, large; dimensions, length, six, diameter, four inches; weight, two pounds; base, slightly flattened; insertion, usually somewhat one-sided; apex, rounded; stem, stout; surface, rough; color, dark green with fairly numerous, small to medium, irregular yellow

dots; skin, thick and tough, separating readily from the flesh; flesh, cream to deep cream, turning to green close to the skin; texture, very smooth; fiber, none; flavor, rich, nutty and delicious; quality, excellent, of the best; seed, medium, round-conic, tight in cavity; season, December at Atlixco, Puebla.

Plate 185. No. 38. A fine fruit of medium size.

NUMBER FORTY

Description: Form, pyriform; size, large; dimensions, length, five and one-half, diameter, three and three-quarters inches; weight, one to one and one-half pounds; base, slightly flattened; apex, rounded, frequently slightly depressed; surface, rough; color, deep green with rather numerous, small to medium sized, irregular yellowish dots; skin, thick, separating readily from the flesh; flesh, cream, turning to green near the skin; texture, smooth and buttery; fiber, none; flavor, rich and pleasant; quality, very good; seed, medium, round-conic, tight in cavity; season, December at Atlixco, Puebla.

NUMBER FORTY-ONE

Description: Form, round-oval to broad pyriform; size, medium large; dimensions, length, four and one-half, diameter, three and three-quarters inches; weight, fourteen ounces to one pound; base, tapering very slightly to stem; apex, rounded, sometimes flattened; surface, slightly undulating; color, deep green with rather few irregular, round, raised russet dots, frequently in patches; skin, thick, hard and granular, separating readily from

the flesh; flesh, deep cream to yellow; texture, smooth; fiber, none; flavor, mild and pleasant; quality, good; seed, medium, oblate-conical, tight in cavity, season, December at Atlixco, Puebla.

Plate 186. No. 39.

MODESTO

A large fruited black variety with a small seed, from Atlixco. It ripens in December and bears an enormous crop. Complete description not available at the present time.

Of all the many different varieties of the avocado sent out to California for trial by the Bureau of Plant Industry, only a few survived the winter of 1912-13. Two of these were from Mexico, and withstood the low temperature without injury. They deserve mention. No. 19206, a green-fruited variety from Coahuila, and No. 19167, a variety from Queretaro. No other descriptions were given.

VARIETIES UNDER TRIAL BY THE WEST INDIA GARDENS

FURNIVAL No. 1

This fruit comes from the Ameca Valley, not far from the town of Jalisco, at an altitude of 4350 feet. The fruit is said to be the finest in the Ameca Valley and is described as being as large as a cocoanut, weighing about two pounds, black in color. The flesh is abundant and of the finest flavor and quality. The seed is medium large and tight in the cavity.

POPOCATEPETL

A large black fruit, slender oval to pyriform, of the thick-skinned type. The quality and flavor are very good. The tree is abundantly productive with off years. From Atlixco, Mexico.

ITZIA

A large oval to pyriform fruit, black in color, with a thick, hard shell. The flavor and quality are of the very best, the seed small and tight in the cavity. Season, December and January.

JOHNSON NO. 5 AND NO. 6

Large hard-shelled fruits of the first quality, from near Colima, Mexico. The young trees growing at the present time in Altadena, show a remarkably vigorous habit. Their leaves are longer than any other variety now growing in Southern California, frequently reaching a length of a foot and a half.

This list brings the imported varieties up to date with the exception of those introduced by Mr. Rideout of Whittier. The descriptions of his fruits are unavailable at the time of writing.

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Volume III MAY 1913 Number 2

Tea Growing in Transcaucasia

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THE UNIVERSITY OF NEBRASKA

It is not generally known that tea is successfully grown in the country lying at the east end of the Black Sea, and south of the Caucasus Mountains. Such, however, is the case, and it was once my good fortune to inspect the plantation under most favorable auspices, and it has occurred to me that it might be of interest to readers of the Pomona College Journal of Economic Botany, if I should write an account of what I observed.

Figure 187. Sketch map of a part of Transcaucasia, showing the location of Chakva and the Emperor's tea plantation.

Just ten years ago (in 1903) I travelled through Russia from Moscow southward across the steppes, to, and finally across the great mountain chain —the Caucasus—which stretches like a wall from the north shore of the Black Sea eastward to the Caspian. North of this barrier is a dry open country where the rich soil when irrigated by the waters of the mountain rivers yields immense crops of wheat and maize, and still further north are the grass covered steppes, wholly treeless except along the meandering streams, quite as on our own Great Plains from Texas to Saskatchewan. South of the

Caucasus range and not more than one hundred miles away the change in climate and vegetation is greater than that usually seen in a distance of half a thousand miles or more. The central and easterly parts of this Transcaucasian region are relatively dry, and here irrigation has long been practiced, but westward towards the Black Sea the annual rainfall increases rapidly until it reaches sixty or more inches near Poti. In this more humid part of the country vegetation is very profuse, the forests being among the densest and richest in the world. In passing it may be mentioned that although this is one of the oldest portions of the civilized world somewhat more than 50 per cent. of the surface is still covered with forests. It would seem that the civilization developed by these people has not required the

Figure 188. Fields of tea plants on the Emperor's plantation.

destruction of the forests, in spite of the fact that the Black Sea ships afforded every opportunity for an extensive lumber trade. And lest some reader might think that perhaps these forests escaped because they were unknown to the outside nations, I will remind him that here was Colchis, the land of the Golden Fleece, that the ancient Greeks knew more than thirty centuries ago. Here on the river Pharis men lived and toiled and built cities, and from these far-away centuries to the present man has lived here. Yet in spite of this long occupancy of the land there are still great forests standing as they stood three thousand years ago.

In this interesting region tea has been grown for many years, and ten years ago I was fortunate in being able to visit one of the plantations under the most favorable circumstances. It is situated near the village of Chakva, between the cities of Batum and Poti, on one of the estates of the Russian Emperor. The estate covers several thousand acres, having a narrow frontage upon the Black Sea, and extending far back eastward into the hills and valleys that lie in front of the low mountains. Near the sea is the Emperor's palace,

Figure 189. Nearer view of tea plants six years old.

and several other buildings, all surrounded by elegant gardens of shrubs, palms, and greensward with an abundance of flowers everywhere. Here Mr. Simonson, the superintendent of the estate, met us, and immediately conducted us to all parts of the tea plantations, passing through thriving plantations of *Eucalyptus globulus*, and tree bamboos (*Phyllostachys*). The tea plantations were back from the sea shore a mile or so, upon the gently rolling hills, and covered large areas of successive plantings. The tea plants were from two to three feet in height, and seen from a distance the fields looked

like extensive plantations of currant bushes with the bushes about five feet apart in regular rows. Nearer by, of course, the shrubs more nearly resembled some of the glossy leaved dwarf almonds. When we visited the plantation the field hands were hoeing out the small weeds between the rows of tea plants, and while the labor was cheap we found that the results were poor. Superintendent Simonson would gladly have employed higher-priced European laborers, feeling sure that in the end he would have had a better return for the outlay. Far better results could have been obtained by the use of horse-cultivators driven by intelligent European, or better still, American farm laborers.

Figure 190. The great tea house or factory on the Emperor's estate.

At the time of our visit,—the latter part of August,—leaf-picking was not going on, so that we did not see this part of the work of tea-making. We were shown, however, how the picking is done, and this appears to be the one difficult and expensive operation in the whole process. Attempts have been made to do this by machines, but with little success. The great tea-house on this estate is a large, plain structure, looking like a very clean and well kept barn, with an unusually large number of windows. It has two stories; in the lower the heavy machinery and the furnaces are placed, while in the upper are the lighter machinery and the tables for the hand-pickers. In this

building we found tea-leaves in every stage from those in the wilting piles to the assorted kinds of tea ready for the market.

We were interested in the heavy machines for rolling the leaves into the characteristic form with which we are so familiar. Each rolling machine consists of a large heavy flat plate about four feet in diameter, on which swings with a rotary motion another heavy, flat plate perforated in its center, somewhat like an old fashioned mill-stone. Above the central hole is a hopper through which are fed the wilted leaves, which later drop from the machine neatly rolled into the desired shape. These rolled leaves are then placed loosely upon flat trays and subjected to the gentle heat of the drying oven.

When dry enough the leaves are dropped upon tables where skilful pickers run over them rapidly and pick out the little sticks and twigs, with other foreign matter that may have become mixed with the tea. It is then passed through cylindrical screens of different fineness of mesh, the different grades of tea depending upon the mesh of these screens. In a row of compartments under these long cylinders one can find every grade of tea down to the coarse "screenings" consisting of little more than twigs and other foreign matter that the pickers failed to remove.

Last comes the packing into cans or paper packages, and the pasting of the appropriate labels. This is done quite as for any other similar commodity. In this particular case, the labels were, of course, in the Russian language, and since the tea was grown and manufactured upon the Emperor's estate this fact was duly set forth, in Russian, also. That this tea is of fine quality we can fully vouch, after testing it many times, and that it is of sufficient importance to find a place in the markets of southern Russia is shown by the fact that we found it in the tea-stores of Jalta, five hundred miles to the westward.

While visiting this tea plantation, and afterward, the question has been, whether there are not places in California where tea might be grown. I have not taken up the questions as to the particular soil and climate necessary for tea growing, preferring to leave that to others, but I venture the suggestion that in the southern half of California there will be found many places between the western sea and the eastern mountain chain where tea can be well grown, and I am sanguine that when once the successful growing of the plants is assured, our ingenious American workmen will be able to surmount the mechanical difficulties connected with the manufacture of California grown tea.

California Street Trees

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Street trees have furnished the topic of much discussion in California where we never lose an opportunity to expound the subject. They form, as it were, a bone of contention which we can ever gnaw and pick and which seems never to lose the savor that bones of contention are wont to hold. The daily papers continually confront us with appeals for more street trees; we read about their charm and beauty in the Sunday magazine sections; we are enlightened as to their desirability and aid in the healthfulness of a community, in all the farm and horticultural periodicals of the state; and then we go to the meetings of the various horticultural societies and civic leagues to learn why we should plant more street trees. We revel in the lore and fondly picture our home city as it will be a generation, or even fewer years hence, when it shall have become a veritable bower of verdure thru our far sighted planting and tender care of its street trees. It has ever been so.

Every home plants trees in front of its sidewalk. Every small town fills its street parkways with trees concerning which it passes many laws and goes to much expense. They are rather costly to buy; require considerable labor for proper planting; must be nurtured during their youth, lest they die of thirst and neglect; must be pruned, as all young things, to influence their direction of growth and curb their natural desires that seem misdirected. But when we have once established them, they afford such delightful places for the small boy to carve his initials while trying out his new knife, and make such lovely fodder for the old family horse that chews them between naps that he takes while waiting at the curb, that we immediately consider their removal thinking they serve the community too practicably. But why should it be that no sooner do such civic improvements become established than we decide that they are in the way of future development of our little metropolis and so must give way to sidewalks and stone gutters? Why do we plant such things and cut them down, and still continue to gnaw the bone of contention?

Now we all appreciate the beauty of street trees, both in the city and the country, enjoying all the while the cool shade that they furnish from the burning rays of our subtropical sun. If we stop to consider, we cannot but remember that they tend to temper the dry heat of our summers by the vast amount of evaporated moisture that they daily transpire from their leaves; that they break the sweep of our trade and storm winds, stopping and holding the while much of the atmospheric dust; and that they consume the poisonous carbon dioxide gas, exhaling in its stead pure oxygen. We love their grace and charm as we fondly recall some well planted avenue that remains ever fresh in our memories. But we forget all of this as soon as we

see a tree standing where we might put in a concrete sidewalk, were the money available. It never occurs to us to save the trees as other countries have been doing for generations, by leaving sufficient space around them for watering and cultivating the soil about their roots which are protected by placing an iron grating over the opening in the pavement so that the pedestrians may not be hindered although the tree is protected. Paris has thus guarded and reared her city street trees for years, till she has become famed the world over for her beautifully planted avenues. We plant our trees, gorge ourselves with good intentions, rave about the beauty to be and phone

Plate 191. *Eucalyptus viminalis.* Were the palms and smaller trees removed to leave only the stately Eucalypts, the beauty of this street would be increased.

for the gardener with his grubbing mattock, while we prepare a dissertation on "Woodman, Spare That Tree."

However, Californians are not in the habit of satisfying themselves with good intentions but rather pride themselves on their initiative, the fame of which has spread as far as that of the state. Los Angeles has appointed a division of county forestry that has among its duties those of planting out county highways and boulevards with roadside trees. I have no doubt that the members of this commission have worked hard and conscientiously. We know that they have planted miles of our roads to trees that they are caring for carefully—but my! what a choice of varieties to testify to posterity the advanced stage of our development and wisdom in things arboreal. How can

we ever look our progeny in the eye as in the future we drive along a boulevard and say to them that we were responsible for having had it planted as it is? For the combinations are pitiful to see. One eighteen mile stretch of good roads has been planted to Himalayan cedars and California fan palms, alternately set every forty feet—a case of forced association between a graceful, adopted child of the forests with a living feather duster torn from the sun-baked sands of our own deserts; another longer stretch of pavement is lined by native red woods and southern magnolias also planted alternately —the one being a giant timber tree, loving the cool mountain slopes, the other a native of the humid tropical swamps of our southern states; a third road is

Plate 192. Pepper tree (*Schinus molle*) is a graceful tree for street planting.

planted to pines and live oaks. In the first place the trees thus planted together are not adapted to the same climatic and soil conditions, some of them being entirely unfit for satisfactory growth in the localities where set; in the second place, four, with a possible five, of these trees are undesirable for roadway planting because of their characteristic growth; in the third place, two kinds of trees should not be used on the same avenue even though our æsthetic sense demands such a variety. But let this much suffice, for we have shown the proper spirit in starting things, and though good intentions will not buy us much, they are very essential to the accomplishment of good things. And we have once more shown that we, as Californians, have initiative.

Now, this matter of selection of proper trees for such planting is a most difficult one, even for those of us who never make mistakes, since there are a multitude of things to be considered in our choice of varieties. Nowhere else is a tree put to so many tests of efficiency as when it is to be used for street planting. First of all, such a tree should be tolerably drought resistant because the copious amount of pavement surrounding it is sure to interfere with its water supply. It should be of a natural healthy and sturdy growth,

Plate 193. Such a planting of mixed Eucalypts in irregular arrangement is very naturalistic and effective for the country road.

unaffected by ordinary insect pests and fungi that attack many of our trees. And it should not be of a rank growing kind that will produce an excess of brittle wood to be torn and broken by the first severe wind to visit the locality. Ideal trees, answering these requirements, are hard to select, but must be found if the question is to be answered satisfactorily.

But a tree that is perfectly hardy and fitted to survive under such stress of circumstances may not be at all desirable for street planting because of

its habits of growth, shape of head or production of troublesome litter. I feel that one of the prime requisites of an ornamental and satisfactory street tree be that it produce shade, for I can see no advantage in trees that do not. If shade is not desired, a row of telephone poles or even lamp posts would be much less expensive to maintain and equally as effective as some of the formal effects that are made by planting palms that soon come to resemble a row of sticks crowned with bristles. Our most beautiful drives are those that, having become shaded by old trees, soften the glare of our summer sun and offer a restful retreat from its heat, being so far more attractive than our canyon-streets, walled with trees of perpendicular or pyramidal growth, as to be obviously preferable. Then in order that it may afford shade for a street, the

Plate 194. California Fan Palm (*Washingtonia sonorae*). This photograph well shows how the palm will convert a street into a canyon. If of much extent, such an avenue would become tiresome.

tree should be of an upright habit so that it will grow away from the sidewalk and yet shade it. I am sure that pedestrians and autoists alike find nothing more annoying than constant brushing and scratching of trees that have been insufficiently pruned. Similarly, trees producing litter are to be avoided, as a littered pavement is always unsightly, sometimes dangerous to the pedestrian and above all a nuisance. It thus seems wise to choose not only a tree that exists under such unnatural conditions, but also to select one that will fulfill the requirements of an efficient and desirable tree.

After deciding on the variety to plant, we quite commonly dig a post hole in the hard ground into which we insert a small plant, expecting it to grow. This is the cheapest way to plant but the most expensive way to rear trees,

thus enabling us to live up to our reputation of sparing no expense in the beautification of our city. The care that many of our trees receive after this manner of planting comes as a luxury to be enjoyed only on rare and memorable occasions. However, there are so many opposing forces that combine in their efforts to undermine the health of the street tree that it seems only fair for us to apply our wisdom and knowledge to the best advantage of our foliaged friends. For instance, most streets, especially where they have been either excavated or filled, contain very poor soil, often clay or adobe, that contains little plant food, besides being hard for the roots to penetrate; the roots are generally deprived of sufficient moisture because of this hard soil

Plate 195. Cocos palms. This palm makes a graceful and attractive plant for the short or curving drive, but would seem monotonous if planted continuously on a long avenue.

and because the pavement keeps away much of the natural rainfall; the soil around the roots becoming packed, does not permit their proper aeration; salt water is often carelessly poured near the roots of trees in our city streets; illuminating gas may seep through the soil, injuring the roots if not destroying the life of the plant; injurious gases in the air, damage from overhead wires or the gnawing of horses may all conspire to injure the tree. These things work against the healthy, thrifty existence of these children of the forest transplanted into an unnatural city environment, undermine their health, threaten their very lives, so that we should bend our efforts to prevent and overcome such detrimental influences.

One of our local horticulturists and botanists is fond of saying that a ten cent tree planted in a fifty cent hole will soon outgrow and always surpass in healthful vigor a fifty cent tree planted in a ten cent hole. He is quite right. Too much attention cannot be given to the preparation of the soil bed that acts for the plant as does the foundation for a building; for it lies at the bottom of the tree's health, theoretically and literally. Where the soil is poor, a hole should be dug from three to four feet deep, sometimes as long as twelve or fifteen feet, and filled with light, loose, rich loam obtained especially for the purpose. If a hardpan exists anywhere near the surface of the ground, the bottom of the hole should be shot with dynamite to crack this layer, thus assuring drainage and conservation of the moisture. Now such preparations seem rather extensive and expensive, but nevertheless become capital stock

Plate 196. Blue Fan Palm (*Erythea armata*). This well illustrates how our public service companies are allowed to ornament the streets. They show even less taste than the ordinary tree planters.

for the city that really desires to have avenues of beautiful trees, for they will save much later expense that would otherwise become necessary, aside from greatly increasing the growth and beauty of the trees.

Now that we have set the tree it might be well to see what we have planted, though this does not generally seem to worry the planter very seriously. I, personally, feel that trees of pyramidal or straight, slender habits of growth are not satisfactory as street trees in California, for they not only afford no shade, but they shut out the wind, reflect the heat from the smooth pavement and add a stiffness and formality to the landscape that detracts from its beauty and becomes monotonous. Most of the palms and conifers fall quite naturally under these two heads and are also being quite generally used as roadside trees.

Take the Himalayan cedar (*Cedrus deodara*), which is a handsome and graceful tree in its place, when planted as an avenue tree. In the first place, it must be allowed to retain all of its lower branches if it is to retain its graceful charm, thus necessitating its being planted along country boulevards that do not have sidewalks paralleling them. In the second place, it encloses the street between two shining green walls that furnish no shade the while they reflect and counter-reflect the radiated heat of the sun. It is of an inimitable beauty as a specimen or lawn tree where it can expand as nature intended, but planted along an avenue, it poorly serves a purpose for which it was not intended. This cedar serves as an example of the conifer type

Plate 197. Golden bamboo (*Bambusa aurea*) is very attractive on a short or curving drive, but excludes all circulation of air when planted so closely. Giant bamboo, planted in clumps, would well adorn an occasional avenue.

which is quite commonly, though, I think, unwisely, used in our roadside plantings.

While the palm will grow up and away from the sidewalk and street as the conifer will not, nevertheless it fails in the requirements for a tree suitable to plant along drives of any considerable length. Where formality is desired, or if planted along short or curved stretches of driveway, the palm is very beautiful. But it does not accord with my ideas of an ideal boulevard tree, because it lacks an umbrageous head and possesses an excessive expanse of bare trunk that becomes monotonous to the eye. One of the accompanying

illustrations well shows what a canyon the palm will in time make of a street. Although while young, many of the palms seem very graceful and beautiful, as they age and shed their old leaves leaving nothing but a bare trunk surmounted by a tassel high above the ground, they present an appearance that becomes tiring if viewed continuously for miles along a country road. The same fault is to be found with the Italian cypress (*Cupressus sempervirens*) and the poplar trees that grow perpendicularly into the air with scarcely any lateral branches. So, in a general way, I would discourage the planting of palms and slender types of trees along avenues of any length.

Plate 198. Olive (*Olea europea*). Hardy, enduring, graceful and ever ready to do service as a street tree.

In relation to street and roadside planting in California, much is said in favor of planting evergreens and nothing but evergreens, even though some of our most beautiful shade and avenue trees are deciduous. Especially along the sea coasts, where the winters tend to be damp and foggy, would it seem advisable to plant an occasional street to a deciduous variety that would admit the light and air during the winter months when the roadways and walks are so apt to be damp and disagreeable. At the same time, such a tree would afford shade in the summer when it is most needed. Some of our most beautiful shade trees are deciduous and I do not think that it gives our landscape a bleak or desolate appearance to possess an occasional clump or avenue of trees that are without their leaves for a few short months of the

year. As a matter of fact, it rather tends to afford contrast with our evergreens, making us realize all the more the wealth of possibilities that our state affords for the growth of different types of flora.

In connection with this word on deciduous trees, I should like to mention among others the native sycamore (*Platanus racemosa*), one of the most picturesque features of our landscapes, both in winter and summer. This hardy tree, admirably adapted to stand the rigors of our climate, should make a good street tree, though I do not remember having ever seen it so planted. Another tree which all Southerners love and which Professor Charles F. Baker of the University of the Philippines strongly advocates, is the tulip tree (*Liriodendron tulipifera*), said to be well suited to avenue planting. One of its characteristic features is the abundance of beautiful

Plate 199. Blue gum (*Eucalyptus globulus*). The old stand-by; tall growing, stately, worthy of California.

flowers that it annually produces. Again, the common chestnut (*Castanea*) thrives well in California, where it fruits to perfection. These trees are all beautiful, hardy, popularly liked: why not plant them on some of our avenues?

Among our commonest and, I think, most beautiful street trees is the pepper tree (*Schinus molle*) which receives much censure and fault finding from the multitudes. It is true that it harbors scale in an infected district where it is neglected and starved; but so do our fruit trees. If, however, a pepper is given occasional water and kept in a healthy growing condition it is found to be remarkably free from insect pests, reducing this tendency to the minimum. It is true, also, that the pepper berries produce annoying litter at certain seasons of the year, but their beauty would more than atone for a considerable inconvenience during this short time. Besides, the combination of the rugged, twisted trunk and feathery, drooping foliage is hard

to excel. This tree will turn a barren, sun-beaten street into an inviting, shady lane so effectively and in so short a time that we should not bar it from our midst for a few minor faults.

In close competition with the pepper, probably exceeding it in numbers, is the Eucalypt in a number of species, the most usual of which is the blue gum (*Eucalyptus globulus*). This is a very rapid, tall growing tree that adapts itself well to the atmospheric conditions of the sea coast. At the same time, it makes an attractive avenue tree where ample space permits its development, and when planted on an avenue of sufficient width to bear well its height.

In our hot inland valleys, the blue gum is supplanted by the manna gum (*E. viminalis*) which grows almost as fast as the former, standing at the same time a much wider range of temperature and thriving where the blue gum will not exist. After a few years, its branches assume a pendulous position that gives to the tree a very pleasing grace and ease of carriage. It is seldom seen as a street tree, but is well suited for planting along our country roads where it has space for its rugged development.

Another tree that should prove desirable for country road planting, in districts that are not visited by heavy frosts, is the Moreton Bay fig (*Ficus macrophylla*), a tree that attains an ultimate height of 100 feet with a spread even wider. Due to the buttressing habit of the roots and to its immense size, it is not suitable for general city planting but would make a most majestic avenue tree, where room permitted. The native live oak (*Quercus agrifolia*) and the cork oak (*Q. suber*) are quite similar in general appearance, although the cork oak grows more erectly and more rapidly than the common live oak. Both of them make admirable avenue trees when matured, but because of their slow growth are often rejected by planters. It would seem, however, that we are planting trees for the coming generations as well as for the present, so that a mere matter of slow growth should not bar a tree that is so beautiful and serviceable as the oak.

A tree that I have never seen on a street, but which would look well on a country road of average width, is the native Island iron-wood, (*Lyonothamnus floribundus*, var. *asplenifolius*). This tree is wonderfully tolerant of drought and the steady cold trade winds of our coast. It has a fernlike foliage and white flower clusters, both drooping gracefully. It produces a hard durable wood that is not easily broken by winds; so that all in all it seems to fulfill remarkably well the tests of endurance that are levied upon a street tree.

Although one might need to protect such fruiting trees with the national guards or at least a burglar proof fence, the avocado (*Persea gratissima*) would make a beautiful, shade-producing street tree. Its foliage is of a bright lustrous green. Its habit of growth is large and spreading. It is a rare fruit tree. But as Germany has made a successful practice of planting fruit trees along her highways, which were thus made to pay for their own upkeep through the harvest and sale of their fruit, why could not Californians show

their progressive spirit by trying such a scheme in this state? The avocado is the solution of the question.

In considering trees that would be fitted to live in our city streets we are confronted with a somewhat more serious problem, because of the necessarily cramped space that does not allow either proper root or proper head development of large trees. One of the saddest mistakes that can be made is to plant a large growing tree in a narrow, cramped street that eventually becomes filled and clogged with its branches. Therefore, we should constantly bear in mind the sense of proportion so that the trees which we plant might appear to the best advantage. Tables have been worked out by municipal specialists who give the proper sizes of trees to balance and harmonize with streets of certain widths and lined by buildings of certain heights. These are obtainable by the person who cares, so that excessively bad mistakes need not be made.

For city planting, the Acacia has been used very much throughout the state, many times in much inferior varieties. As a general thing it has so brittle a wood that it is easily broken by the wind or the weight of its own flowers. Some varieties, especially *A. melanoxylon,* the black wood Acacia, sucker from the roots, thus becoming very troublesome in the parkways. There are kinds, however, that if given proper and intelligent care make a very attractive tree that is well worth one's bother. The vast number of varieties of this genus permits much leeway of choice.

The common camphor (*Cinnamomum camphora*) is frequently seen, though often accused of growing ununiformly in height, when planted along a street. I think that were this tree properly planted and cared for, it would make a most satisfactory tree for this purpose, as it is of an upright habit of growth, with a compact head and beautiful glossy foliage. In time, too, it will grow to a considerable height.

The carob tree or St. John's bread (*Ceratonia siliqua*) has recently become something of a favorite for this line of planting. It is comparatively slow of growth and spreading in habit, but if properly trained and encouraged will grow into as fine a tree as any of the more promising seedlings. Its dark glossy foliage gives it a richness of color that is hard to equal, while its branching head makes an ideal sun shade. It will stand dry weather, heat and cold in a way that makes it valuable for planting in a varied range of localities.

Although *Pittosporum undulatum* is subject to scale, especially when neglected, it is well adapted to street planting in the residence districts of our cities. It has a profusion of sweet scented bloom in the spring, followed, unfortunately, later in the season by dropping seeds and seed husks that strew the ground beneath. A close relative to this tree is *P. rhombifolium,* quite similar in habit though probably higher growing and a little more desirable than *P. undulatum.*

The Catalina cherry (*Prunus integrifolia*), a native of Catalina Island, makes a beautiful small tree with a spreading head and sufficient size to warrant planting it on a small street. The foliage of this tree is a rich glossy green; the tree blooms profusely and produces a red cherry that is rather attractive in appearance.

The mayten tree (*Maytenus boaria*) grows to a medium height in a quiet, modest way. Its foliage is fine, graceful and drooping, though rather sparse and casting only a moderate shade. Its size would not be sufficient to balance and harmonize with a wide street, but is enough for some of our more narrow city ways.

A tree that is sometimes seen along our roadways, but which in my estimation might well be planted oftener, is the common olive (*Olea europea*). It has a delicateness and softness of outline that seems to blend with and soften the tone of almost any environment in which it is placed. It is very hardy, drought and cold resistant, so that one need not be especially careful of the locality in which it is planted. It makes a comparatively slow growth, but is long lived, attaining an ultimate height sufficient for the ordinary street. However, if the fruit is unpicked, its litter is very troublesome and dangerous.

So much for varieties. There are faults that might be found with all of the plants that have been here mentioned, although, judging from what one commonly sees, many of us cannot be overdiscriminating in our choice of street trees. Time only will tell us of that which, making a splendid growth while young and seeming to be happily chosen at the time, may turn out to be absolutely unworthy after a few years have given it an opportunity to demonstrate its value. So, too, is it that the unpromising seedling may in the end prove to be the best possible tree for the purpose.

The accompanying half tones give some examples of good and bad planting, and good and bad selection of road trees. And although it is largely a matter of personal taste as to what is beautiful and what is not, there seem to be certain requirements that a satisfactory tree must fill. Careful consideration, deliberate judgment and common sense, if judiciously used, will solve many of these hardest problems for us.

Babylonian Dates for California

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The greatest date-growing region in the world is the country between Mesopotamia and the Persian Gulf, which is now properly called 'Iraq and is a part of Turkey in Asia, but which I shall call by its ancient name of Babylonia, as more familiar to Occidentals. Its dates, which we have been accustomed inaccurately to call "Persian Gulf dates," have long held a practical monopoly of the American market; but when the culture of the palm began to be taken up seriously by California ranchers, they drew nearly all their stock from Algeria, because of the greater accessibility of the North African oases.

Most of the varieties thus secured, however, are late in maturing, and when they became well established, it was realized that an extension of the season, by the addition of earlier varieties, would be of great value to the industry here. Late dates like Deglet Núr do not get into market until the fresh importations from Babylonia have arrived, and they must compete with a flood of fruit which can be laid down in the United States for less than five cents a pound. If, however, California growers can market a considerable portion of their crop in August and September, they will have a market empty of dates, when any good fruit will find a ready sale at a remunerative figure.

It was known in a general way that the Babylonian varieties would meet this need. The Bureau of Plant Industry of the United States Department of Agriculture had introduced a number of them on an experimental scale, following a visit of David Fairchild to the region in 1903, and among the varieties thus secured were several that ripened earlier than anything theretofore known in the United States. In fact, Arizona growers did not hesitate to say that the "Persian Gulf" varieties would practically be the making of the industry in their state,* since the best from Algeria matured at a time at which the crop was usually ruined by rain.

Under these circumstances, the West India Gardens, of Altadena, Los Angeles County, California, sent me to the region in question, to spend the winter of 1912-1913, make as full a study of the date varieties as possible, and introduce the best of them to the United States on a large scale. I began with a visit to the home of the Fardh date in Oman,† on the eastern coast of Arabia, and then spent nearly four months in Busreh, near the head of the Persian gulf, and Baghdád, 500 miles farther north. In this region I was able to list 112 varieties of dates, descriptions of most of which, including

* Popenoe, Paul B., in Bul. Calif. Comm. Hort., I, 10, p. 877. The Arizonans have since come to prefer Egyptian dates.

† Popenoe, Paul B., in Bul. Calif. Comm. Hort., Jan., 1914.

even many of the best, have never before been published, and to bring to California 9,000 offshoots, which arrived in remarkably good condition and are now divided between many growers in the Coachella Valley and elsewhere.

It is my purpose in this paper to describe the varieties of dates grown in Babylonia, not only for the importance which such descriptions will necessarily possess for Californians growing the varieties in question, but as a guide for future visitors to that region; for I believe it is the most promising known, from which to draw a large supply of high-grade offshoots for the United States.

Although the dates of Busreh are better known, and more important commercially, and are now and always have been* considered, even by Arabs, as the best, my opinion—as is that of my brother, F. W. Popenoe, who accompanied me, and to whom I am indebted for much assistance in preparing descriptions—is that the Baghdád field is incomparably richer. Commercialism at Busreh has tended to restrict planting to the three great export varieties, Haláwí, Khadhráwí and Sáyir, and none of these can be considered a superfine date, although for a steady diet Khadhráwí is as satisfactory as any grown. Yet Haláwí is more profitable, since its lighter color makes it a favorite in the American market. The price received for this variety by growers in 1912 (when the crop was large) was $2.22 per maund of 153 pounds. The prices of Haláwí, Khadhráwí and Sáyir, respectively, were in that year as 320:260:220. There is, thus, no doubt as to what is the most profitable date at Busreh, the choicest varieties, like 'Awaydí and Barhí, being cultivated to a very limited extent indeed.

In Baghdád the dry date Záhidí is most widely cultivated, and there are no virtues which growers do not ascribe to it. There are many finer ones, but Záhidí has come to be the choice of the nomad tribes who are the chief consumers of Baghdád dates, and as it is early, hardy, vigorous, and unusually prolific, the growers plant it so largely that many groves contain nothing else. It is usually considered the most profitable there, but some growers put Khustáwí ahead of it, because of the higher price it commands, in spite of its lighter yield; Asharasí, Maktúm and Tabirzál probably come next in order, but the last two are hardly cultivated on a commercial scale and, as a matter of fact, one sees Busreh Khadhráwís sold in the Baghdád bazar more frequently than any of the local varieties.

The first ripe dates are eaten by the natives in July, but it must be admitted that an Arab will eat dates when they are still so hard and full of tannin that American hogs would hardly touch them. Perhaps August first might be taken as the commencement of the date season in an average year, while it is not in full swing until a month or six weeks later. Within a month all of the principal varieties have been picked and sold; in forty days the

* Besides medieval Arab writers, cf. Marco Polo's description in the latter half of the 13th century, "There is also on the river (Tigris) as you go from Baudas (Baghdád) to Kisi (Kish) a great city called Bastra (Busreh; classically Basreh), surrounded by woods, in which grow the best dates in the world."—Yule's Ed., I, 60, London, 1871.

packing season is virtually over. The extremely early dates of Babylonia are Ibráhímí, Haláwí Makkáwí, Balabán, Makkáwí Ashqar, Bárbán, Badinjání and Sultání, while Záhidí and the Busreh Haláwí will have to be put on the edge of the list.

The later dates, on the other hand, continue to ripen well up to December first. Khasáb, Hilálí, Shatwí, Lúlúí and 'Amámet al Qadhí can be had fresh in any quantity up to the middle of November at least.

The dates of the region average well in size, and the dry varieties, in particular, are conspicuously larger than the similar dates of Algeria; they are also of better quality, on the average, while the best of them reach a perfection that was never dreamed of in the Sahara. Babylonia's largest dates, I should say, are 'Awaydí, Bú Saba'a al Dra'a, Madaní, Sayyid Ibráhím and Ism'aíl Qadrí,—all of them rare.

Arab scientists classify the principal varieties as hot or cold, according as a long-continued and exclusive diet of them "burns" the stomach or not. The distinction is important in a country where people eat little except dates, but it will not be worth considering in the States, where a handful a day is a heavy ration. Khustáwí is universally considered the coldest date known: one can eat five pounds daily for a year and never feel them. Bárbán, at Baghdád, is considered the hottest, but is valued, nevertheless, on account of its earliness. As a matter of fact, not only most of the varieties, but most of the choice varieties, are considered hot. Among the cold ones are Khadhráwí, Sukkarí, Shukkar, Amír Hajj, Sukkar Nabat, while Maktúm and Badráhí are placed in an intermediate class, neither hot nor cold, but satisfactory. Asharasí, Tabirzál, Haláwí, Záhidí, and Barhí, most of the other dates of sufficient importance to receive classification, are on the hot side of the ledger.

As to the best date of the region, Arabs agree in awarding the palm to the Khaláseh of Hasa* which, however, is little grown outside its original home. I think this judgment is correct. My own second choice is Maktúm or Tabirzál, but many of the Baghdádís swear by Sukkarí—in fact, that would probably have more votes than any other at the City of the Caliphs. Khustáwí has many admirers. The originator of the variety Khiyára declares that none can equal it. Those partial to dry dates affirm that nothing surpasses Asharasí. At Busreh, 'Awaydí and Barhí are tied for first place. Sultání is the choice of the Hilleh growers. Amír Hajj is esteemed, but the rare Jamál al Dín, Baqlah and Gul Husaíní from the same region are considered quite as good, if not better. Those who have tasted Khasáwí al Baghal call it excellent. Brím is considered one of the finest known dates at Baghdád, while at Busreh it is held to be fit only for boiling. In short, it is all a matter of taste, but if one took Barhí, 'Awaydí, Khustáwí, Maktúm, Tabirzál and Sukkarí as the best of the region, he would not be far wrong; leaving the

* Cf. Palgrave, W. G. Narrative of a Year's Journey through Central and Eastern Arabia, vol. II, p. 172, London, 1865.

others I have mentioned as second choice, with the incomparable Khaláseh always in a special place of honor.

As for the worst ones, the two Sáadas, Sharisí, Ja'afarí, Hamráwí, Haláwí and Asshag will have to fight for the leather medal among themselves. One sometimes finds in the bazars worse dates than any of those, but they are merely seedling fruit. The varieties named are as bad as any one would care to perpetuate.

Methods of culture differ little in Babylonia from those in other Arab countries, and I therefore omit any description of it, particularly since it has been treated by Fairchild* fully and satisfactorily.

In transliterating the Arabic names of date varieties, I have followed the system now universally adopted by scientific men—namely, that consonants should be pronounced as in English and vowels as in the continental languages —e. g., Spanish. This system, which was elaborated by the International Congress of Orientalists at Geneva in 1894, has the merit of being both uniform and simple.

The following list, arranged in alphabetical order, contains the varieties which I was able to list in Babylonia, either from my own observations, or from the descriptions of native acquaintances; but as I have recently published† descriptions of most of the varieties now in California, at some length, I omit these in order to save duplication. For the following Babylonian varieties the student should, therefore, consult my book on Date Growing:

Anjasí, "The Pyriform."
Asibi' al 'Arús, "The Bride's Fingers."
Asharasí, "The Tall Growing."
'Awaydí, "The Little Big One."
Bajlání, named after a tribe of noted date-growers.
Badinjání, "The Egg-Plant Date."
Bárbán, "The Fair Persian."
Barhí, named after a hot wind supposed to ripen it.
Brím, (origin of name disputed).
Dubaíní, named after the oasis of Dubai, near Baghdád.
Fursí, "The Persian."
Guntár, properly *Qintár,* "The Hundredweight."
Haláwí, "The Sweet."
Haláwí Makkáwí, "The Sweet Date of Mecca."
Hasan (or *Husain*) *Effendi,* (a man's name).
Hasáwí, from Hasa.
Ibráhímí, "Abraham's Date."
Khadhráwí, "The Verdant."
Khustáwí, "The Date of the Grandees."

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* Fairchild, David. Persian Gulf Dates and their Introduction to America. Bul. No. 54, Bureau of Plant Industry, Washington, D. C., 1903.

† Date Growing in the Old and New Worlds, by Paul B. Popenoe. West India Gardens, Altadena, Cal., 1913.

Maktúm, originally *Makdúm,* "The Bitten."
Maktúm Ahmar, "Red", a variety of the preceding.
Shukkar, "Sugar."
Sukkarí, "Sugary."
Sukkar Nabat, "Refined Sugar."
Sultání, "The Sultan's Date."
Tabirzál, originally *Tabirzád,* "Sugar Candy."
Záhidí, "Nobility."

The varieties in the foregoing list are all to be found now in the United States. The following list comprises all the other varieties of which I could learn in Babylonia; they are not growing in the United States, unless so described, but many of them should be given a thorough trial as soon as possible.

OTHER BABYLONIAN VARIETIES

'Abadlí, "The Date of Abdullah" (a man's name), a large, soft date, light reddish-brown in color, grown principally in the oasis of Baqúbah, near Baghdád. Usually eaten fresh, but keeps well if packed tightly. Ripens about the middle of September. Quality good. Yield fairly heavy.

'Amámet al Qadhí, "The Kadi's Turban," a large, yellow, dry date, very thick in proportion to its length; ripens late in season and is of mediocre quality. Mostly eaten fresh, but not a common date. Seed large. It is occasionally picked when still soft and packed in skins.

Amír Hajj, "Leader of the Pilgrimage," a date practically confined to the oasis of Mandalí on the Persian frontier. It is ranked among the best dates of Babylonia, partly because of its quality and partly because of its attractive appearance and its scarcity. Nowadays it seems to be exported only in the form of presents. The few trees are in the gardens of wealthy men who refuse to sell offshoots from them, consequently the variety is not disseminated.

The palm is tall and graceful, but very delicate, requiring a great deal of cultivation and water; a shy bearer. It matures its fruit in midseason.

Many seeds of this variety have been planted in California, all efforts to secure offshoots having failed.

In form, the date is broadly oblong-oval to oblong-ovate, flattened at base, widest at or near center; apex rounded to broadly pointed, base flattened. Size medium large, one and one-quarter to one and three-eighths inches long, seven-eighths to one inch wide. Surface dry or nearly so, roughly undulating, slightly glossy where the thick bluish-gray bloom has been rubbed off; deep, rich orange brown in color, unusually translucent. Skin firm but rather thin, not easily broken, though tender; loosely folded, the folds rather prominent but only occasionally separating from the flesh; no blisters. Flesh three-eighths inch thick, of caramel consistency, translucent, light golden brown in color; fibrous lining of seed cavity yellowish cream colored, fibre tender

and unnoticeable in the mouth. Seed rather small, three-quarters inch long by one-fourth to three-eighths inch wide, oblong to oblong-obovate, blunt at base, slightly tapering at apex; smooth; deep, dull brown in color; ventral channel almost or entirely closed; germ pore at or near center. Flavor very rich and pleasant, not so sweet as to be cloying nor so strong as to be objectionable. Although the date somewhat resembles Maktúm in appearance, the flavor is entirely different.

'Arab Síkí, (Turkish), "The Arab's Phallus," a variety mentioned by G. Ghanímeh in an article on the Palms of 'Iraq in Al Machríq, No. 11, p. 480, Bayrút, June 1, 1907. I could not find this variety.

Asharasí Aswád, ("black"), a rare sub-variety of Asharasí at Baghdád. Form broadly obovate, sometimes almost spherical; base broad and flattened, apex rounded to very broadly pointed. Of very solid consistency, but not hard. Size medium large, length one and one-fourth to one and one-half inches, breadth one to one and one-eighth inches. Surface dry, rough, slightly glossy, deep purplish maroon in color, bloom unnoticeable. Skin rather dry, moderately thick but not tough, coarsely wrinkled indiscriminately, and toward apex separating from flesh in numerous folds and blisters. Flesh solid, gummy, one-fourth inch thick, translucent light brown under skin one-third of distance to seed, the rest light straw color. Slightly fibrous around seed cavity. Seed broadly oblong, blunt at base, rounded at apex, plump, eleven-sixteenths inch long, five-sixteenths broad, smooth, cinnamon brown in color, ventral channel open, rather shallow, germ pore slightly nearer apex. Flavor rich and nutty, quite similar to that of Asharasí.

Ashqar, "Sorrel," referring to its color. This is the Busreh name; at Baghdád the word is made feminine instead of masculine: Shaqra. A long slender date of rather above average size, sorrel colored, ripening in September. Considered good when fresh, but does not keep well. Bears heavily. Not common in either district.

'Ashúrí, a name which indicates that the date ripens in the first ten days of the month,—but I do not know which month. It is a very rare Baghdád soft date, resembling Khustáwí but a little larger. Ripens in midseason; yield good; the date is noticeable for its tender skin.

'Ashsháq, "The Preferable," I take to be the true form of the date vulgarly called "Asshag" at Busreh. It is a mediocre variety ripening in October. Long and slender, almost black; keeps well but is not good as rutab (fresh dates). Bears heavily. Not common.

Awashah, (a woman's name), originated in a garden owned by a woman of that name at Mu'adhdham, near Baghdád, and is confined to that neighborhood. Yellowish brown in color, long and of medium thickness; midseason. Opinions differ as to its value, some declaring it worthless while others represent it as a delicious fruit with notably tender skin.

Aweríha (?), variety reported from Hilleh, of which I could get no description.

Azraq, "Brilliant," a good soft date principally grown at Mandalí and Badra. Form oblong-ovate, rounded at base, broadly pointed at apex. Size medium, length one and one-fourth to one and one-half inches, breadth at widest point, at or near center of fruit, five-eighths to three-fourths inch. Surface rather rough, light brown in color, glossy, bloom unnoticeable. Skin firm but thin, rather tough, loosely wrinkled indiscriminately, occasionally blistered, but otherwise adheres closely. Flesh very firm and of caramel consistency, good texture, three-sixteenths inch thick, translucent, light reddish brown in color, slightly fibrous near seed. Seed oblong, slightly pointed at both ends, three-fourths to seven-eighths inch long, five-sixteenths inch broad, smooth, grayish brown in color, ventral channel open but narrow. Flavor sweet but the taste of syrup rather more prominent than that of dates.

*Banafshah,** "Violet Blossoms," a dry date of attractive appearance but ordinary quality, grown around Baghdád but more at Mandalí. Form oblong, slightly swollen toward the apical end, the base bluntly flattened, the apex rounded or very broadly pointed. Size medium large, one and one-fourth to one and one-half inches long, five-eighths to three-fourths inch wide. Surface smooth or coarsely wrinkled longitudinally, dry, hard, dull purplish maroon in color with slight bluish bloom. Skin thin, dry, moderately tough, adhering closely except for an occasional fold, usually somewhat wrinkled toward apex and smooth near base. Flesh dry, solid, mealy, one-eighth inch thick, dull white in color, sometimes slightly soft near apex. No fibre. Seed very large, oblong, blunt at base and rounded at apex, one inch long, five-sixteenths inch broad, smooth, fawn colored, ventral channel open, deep, germ pore slightly nearer apex. Flavor sweet but lacking in character.

Baqlah, "The Pot Herb Date" (?), a large, yellowish brown date with small seed, which ripens about the middle of September and is known as a heavy bearer. Considered best when fresh, but, also, packs well. It is rare, if known at all, in Baghdád, and seems to have originated somewhere on the Persian frontier. Those who have eaten it call it delicious. I ordered some offshoots of this variety from Badra and received four specimens labeled "Daklieh," so I do not know whether I introduced it to California or not. Sayyid Salman Abatshí who is considered an authority on dates at Baghdád, declares it is the best variety in Babylonia.

Badamí, "Almond-like" (Persian), a rare Baghdád soft date which is highly esteemed. Medium large, light brown in color; ripens early in September. Eaten as rutab (fresh dates) or packed in skins or boxes.

Badráhí, from the oasis of Badra, although those of Mandalí are considered better. The palm flourishes in a sandy soil and is rarely found at Baghdád, in fact, I was unable to secure any offshoots of it. The date is much liked by the Baghdádís, but the whole supply is shipped in. The palm

* This is the Persian word, but is usually heard at Baghdád, as are many other Persian words, because of the large Persian population there. The classical Arab form *Banafsaj* is, also, heard; it is merely a corruption of the Persian; by the time the word reaches Algeria it has degenerated to *Balasfanj.*

is easy to cultivate, but bears moderately; it has been a decided success in California. Season, late September.

Form broadly oblong, tending to oblong-oval and oblong-obovate, broadest between center and apex. Base slightly flattened, apex broadly pointed. Size medium to medium large, one and one-fourth to one and three-fourths inches long, seven-eighths to one and one-eighth inches wide. Surface hard and dry, smooth to roughly undulating, rarely wrinkled; brownish straw colored, sometimes darker toward apex and lighter toward base. Skin hard, dry and brittle, adhering closely to flesh and rarely wrinkled or folded. Flesh three-eighths inch thick, light straw colored, very hard and solid, not mealy, free from fibre. Seed oblong-elliptical, slightly tapering at base and pointed at apex, three-fourths inch long, five-sixteenths inch wide, fairly smooth, deep brown in color, ventral channel open, narrow; germ pore slightly nearer apex. Flavor remarkably sweet and delicate, almost honey-like, with very little of the nutty flavor that characterizes *Asharasí*.

Bayt al Sabáh, "Breakfast Food," a scarce Busreh variety of slight value. The fruit is large, short and thick, light brown in color, and ripens about October first. Principally eaten as rutab; the dried date keeps fairly well but is inferior. Heavy bearer.

Balabán, perhaps "The Date of Bán," a region in Arabia always famed for its dates. A small, short, brown, soft date which seems to be confined to one garden at Baghdád and is said by its possessor to ripen almost a month before any other. The palm is of rank growth, resembling a male in appearance, and bears well. The dates are eaten fresh, packed in skins, or cured to a caramel consistency.

Burní, "The Sweetmeat Jar"* (Persian). An Oman variety, very rare at Baghdád. I met men who had heard of it there but never one who had actually seen it.

Bú Saba'a al Dra'a,† "Father of Seven to the Cubit," describing its length. This is the name at Busreh and Abu'l Khasíb; at Baghdád it is called merely Saba'a al Dra'a. A long and slender variety of mediocre quality, very rare and grown more as a curiosity than anything else. Dark brown in color. The fresh fruit is not good, nor is it much better when fully mature.

Busráwí, "From Busreh," a variety grown at Baghdád, but not common, although esteemed because it bears early (August). A large, soft date, of which two sub-varieties are distinguished, "Asfar" or yellow and "Ahmar," red.

Chayán, "Tea-flavored" (Persian), a variety of which I heard the name only.

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* This derivation was given me in Masqat, and is quite legitimate. Birní is one of the most famous classical varieties, and all ancient authorities mention it in Babylonia; I can not prove, however, that the present Burní is identical with it. There seem to be two or more varieties confused under the latter name at present. The etymology of Birní is certainly not that given above.

† Properly the word should be transliterated *Dhira'a*. There are three cubits in use at Busreh, of 18, 25 and 27 in., respectively.

Chibchab, see Kibkab.

Dafr al Ghazál, "Gazelle's Dung", a Busreh variety, very scarce, eaten only as rutab. Of medium size and slender, yellowish brown in color, ripening about September fifteenth. Quality good.

Degal 'Abbás, "The Date of Abbas" (a man's name). A rare but esteemed Busreh variety whose fruits ripen about October first. The date is small, long and slender, light brown in color. Bears at an early age and heavily; the fruit keeps well.

Degal 'Amad, "The Columnar", a Mandalí variety, of which a few palms exist at Baghdád. Very small, no larger than the end of one's finger, but of good quality. Light brown in color and of moderately soft consistency when cured, but usually eaten fresh.

Degal Khatún, "The Lady's Date," a scarce and inferior Baghdád dry date, also eaten rutab. Yellowish-brown; midseason.

Degal Múza, "The Banana Date," a Busreh variety probably identical with Qush Múza of Oman. Fruit small, short and of medium thickness; same color as Khadhráwí. Ripens September fifteenth to twentieth. Eaten fresh; keeps well but is not so good when cured. Yield good. Most gardens of any size have a few trees of this variety to provide early rutabs (fresh dates) for family use.

Dairí, said to mean "Of the world," i. e., "grown everywhere," but it is possible that it means the Monastery Date, referring to the famous Daír al Balah (Monastery of Dates) at Gaza (Ghazzeh) in Palestine, where the Egyptian Hayání, called Birket al Hajjí in America, is much grown. If so, the Busreh Dairí would be Hayání (Birket al Hajjí). It is one of the commonest "soft and dry" dates of Busreh, but of inferior quality. It is sometimes packed in skins as a soft date. The offshoots come into bearing at an early age, but the yield is always rather light. Not eaten in the fresh stage. Ripens about October first .

Form oblong to oblong-ovate, widest near center, whence it narrows slightly to the broad and obliquely flattened base, and more pronouncedly to the broadly pointed apex. Size large, one and one-half to one and seven-eighths inches long, three-fourths to one inch broad. Surface almost smooth, translucent brownish red to light maroon in color, overspread with a thin, gray-blue bloom. Skin thick, tough, adhering closely except for occasional longitudinal or transverse folds; wrinkling almost none. Flesh firm, tender, one-quarter inch thick, translucent, deep amber colored. Seed oblong, blunt at base, slightly pointed at apex; one inch long, three eighths wide; smooth, light brown, ventral channel broadly open, germ pore two-thirds of distance from base to apex. Flavor sweet but lacking in character and with unpleasant after-taste.

When allowed to become dry, the date is similar to the above, save that the flesh around the base becomes whitish, opaque, granular and dry, sometimes extending in a layer around the seed cavity, almost to the apex of the fruit.

Findúqích, "The Filbert," an alternative name for Jaúzí.

Gul Husaíní (Persian), The Rose (or Flower) of Husaín (a man's name), an extremely rare variety from Mandalí, on the Persian frontier; it is apparently unknown at Baghdád and Busreh. Large, soft, usually eaten as rutab only, and said to be superior to the better known Amír Hajj of the same oasis.

Halái, named after the village of Hala (?), one of the poorest of the Busreh dates; ripens early in October, and bears heavily. A yellow, dry date, about the size of Haláwí. Not common.

Hamráwí, an inferior Busreh soft date ripening in the last week of September. Its name suggests its color, "reddish," in shape it is small and slender. Scarce, shy bearer. Cures well and can be kept six months.

Hanúshíyeh, "The Date of Hanúsh" (a man's name), a rare Baghdád dry date of good quality but poor appearance. Form oblong to oblong-elliptical, broadest a little below center, base flattened, apex rather sharply pointed. Size medium large, one and three-eighths to one and five-eighths inches long, seven-eighths broad. Surface dry, roughly undulating, a dull, yellowish brown in color, often tinged with magenta near base; bloom unnoticeable. Skin medium thick, tough, dry, freely blistered and folded, and not adhering closely except around base. Flesh clear white or nearly so, changing to translucent amber brown near tip; three-eighths inch thick, solid, meaty but not mealy; fibre very slight. Seed oblong, rather slender, rounded at base, broadly pointed at apex, seven-eighths to one inch long, three-eighths to one-quarter inch broad, smooth, gray-brown, ventral channel closed or nearly so, germ pore nearer apex. Flavor very sugary, slightly nutty, similar to that of Badráhí and about as good. Ripens midseason.

Hiláli, "Moonbeams,"* a delicious yellow date of the Persian Gulf, fairly common at Busreh, and providing rutabs up to December. It has been successfully grown in California, but its late maturity is a drawback to its wide cultivation. Described in Bul. Cal. State Com. Hort., Jan. '14.

Huwayzí, named after the town of Huwayzeh, sometimes spelled Hevezi, and frequently confounded with 'Awaydí. A choice Busreh soft date which is usually eaten fresh; the Arabs say it is inferior when cured, but this statement is hardly justified. A fairly long, slender date, more or less similar to Haláwí both in shape and color which is light brown. Ripens about the last week of September; the palm bears well from an early age, but is not common. Flavor delicate and pleasant. The fruit will keep for five or six months in good condition; experimental shipments made to New York have been successful.

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* Literally, "The Crescent Moon." The root is an ancient Semitic one, and it is interesting to note that it is found in the expression Halleluiah = Hallelú-Yah, i. e., Lord of the New Moon; a liturgical phrase indicating that the ancestors of Abraham were devoted to the worship of the moon.

Ism'aíl Qadrí, (name of a man), a scarce Baghdád dry date which is also eaten in the rutab stage, and is esteemed. Bears well, late in August. Size large, color yellow, sometimes with a reddish-brown tinge.

Ja'afarí, "Refined Gold" (also a man's name), a rare and bad dry date of the Baghdád district. Yellow in color; so astringent that it is eaten only by camels.

Jamál al Dín, "The Beauty of Religion," a Mandalí date, which some connoisseurs esteem the best of that oasis, very rare at Baghdád. It is the earliest of the choice Mandalí dates to mature (August), and is usually eaten fresh, but occasionally preserved in skins. Light brown in color, fairly large in size. There is said to be no commerce in this variety, but wealthy proprietors at Mandalí each have a few trees for their own use.

Jaúzí, "Like an English Walnut," a name which well describes both shape and color. An excellent dry date of the Baghdád district, not eaten in its soft state; bears heavily, shortly after midseason. Not very common. It is sometimes called Findúqíeh, or vulgarly Bindúqíeh.

Form broadly oval to almost spherical, widest near center. Base rounded, apex blunt to rounded. Size medium large, one and one-fourth to one and three-eighths inches long, one and one-eighth to one and one-fourth inches wide. Surface very rough, hard, dry, yellowish brown in color tinged with magenta; bloom unnoticeable. Skin medium thick, tough, deeply and coarsely wrinkled but adhering to flesh except for an occasional blister around apical end. Flesh very solid but not mealy, one-fourth inch thick, translucent brownish amber close to skin, creamy white toward seed; white portion three-fourths of whole. Seed broadly oblong, plump, three-fourths inch long, three-eighths broad, both ends broadly pointed; smooth, russet, ventral channel closed. Flavor sweet, nutty, mild and rich. The fruit varies considerably, however, and very inferior dates of this variety are sometimes found in the bazar.

Kákáwání, also spelled Kikawani and Chichawani, a variety mentioned by Ghanímeh but unknown to me. The name is Persian; a lexicographer says it means "excellent; applied to dates which have no seed." This is confirmed by Al Hamdaní, who gives in his "Description of Arabia" (10th century) a list of Busreh dates and among them: "Al Sísa, and it is called by the Persians Kíka and Chícha and by the Arabs Al Fakhir (the fine) and probably it has a defective seed * * which can be eaten." I suspect that this variety is merely a Shís [An unfertilized or unpollinated date.—Ed.].

Kand Káwí, "The Bull's Penis" (Persian), a variety of which I heard the name only.

Khalásch, "Quintessence," the date of Hasa in Arabia, considered by Persian Gulf Arabs to be the finest in the world. It is extremely rare at Baghdád; at Busreh it is being planted a little more extensively of late years, but is not yet common. The quality of the fruit at Busreh is rather inferior;

it undoubtedly prefers a sandy soil. At Baghdád the growers claim its quality shows no deterioration; the annual yield is from 100 to 150 pounds.

I secured about 400 palms of this variety from Oman and Hasa; it is fully described in Bul. Cal. State Com. Hort., Jan. '14.

Khanayzí, (name of a tribe), an Oman variety, occasionally found at Busreh. Described in Bul. Cal. State Com. Hort., Jan. '14.

Khasáb, "The Abundant Producer," a variety that seems to be native of Oman, but is now becoming fairly common at Busreh, where it is valued because of its late maturity—fresh dates can be had from it until almost the first of December. It is rarely cured.

In the bazar the date is usually seen attached to the cluster, and before softening is of a bright, rose-red color, ovate-elliptical in form, widest near the middle and tapering slightly toward both ends. As it softens the skin becomes translucent and assumes a deep, reddish amber color, becoming sticky from the exudation of syrup.

The following description is of cured dates of this variety obtained in the Busreh market: Form broadly oval to broadly ovate, widest at center or slightly nearer basal end, thence tapering to the narrow, flattened base and the broadly pointed apex, size medium, length one and one-fourth inches, breadth seven-eighths inch. Surface irregular, reddish brown to prune purple in color, overspread with a thin bluish bloom; skin moderately thick, tough, coarsely wrinkled, transversely and longitudinally, but generally adhering closely to the flesh; flesh firm, tender, one-fourth to one-eighth inch in thickness, translucent, deep amber colored; seed oblong, round or blunt at base, pointed at apex, three-fourths inch long, five-sixteenths broad, smooth, deep grayish brown in color, ventral channel open, shallow, germ pore nearer base than apex; flavor sweet but lacking in character and with a rather strong after-taste.

Khasáwí al Baghal, "The Ass's Testicles,"* a variety said to be common and esteemed in Madína. It was introduced to Mesopotamia several generations ago but has never become widespread. The date is of large size, brown in color; eaten either fresh or cured.

Khíyara, "Cucumber-like" (Persian), a soft date originating with Mullah Nají of Baghdád, who claims it is the best in Babylonia. Long, slender, brownish-yellow, with a small seed. A heavy bearer and the bunches are very large; ripens in August. The flavor when fresh suggests that of a cucumber; packs and keeps well. Very rare.

Kibkab, often spelled (and pronounced) Chibchab or Chipchap. The word is Persian but its derivation uncertain; the best native lexicographer merely says it means "a palm which lets its fruits fall before they are ripe." I incline to the meaning, "The Date of the *Chab* tribe (properly Kab, a powerful and widespread tribe of nomads) on the left *chib*; (this is, the left bank of the Tigris)." It is a fairly common date throughout the Persian gulf; some-

* Al Muqaddisí (died 985) who lists 45 varieties of Busreh dates in his book "Ahsan al Taqásím" mentions Baydh al Baghal, "Ass's Eggs," which is very likely the same variety.

times eaten in a half ripe stage but usually boiled to form what is called *Kharak Pokhta* in Persian and *Khalál Matbúkh* in Arabic, in which state it forms a considerable article of export to India. The date ripens about October first, and the yield is large.

Form oblong-elliptical, widest near center, thence narrowing slightly to the flattened base and broadly pointed apex; size large, one and one-half to one and seven-eighths inches long, seven-eighths to one inch broad; surface hard, rough, golden brown in color; skin thick, hard and brittle, with many deep longitudinal wrinkles and a few transverse ones, but adhering very closely to the flesh, which is hard and dry, coarsely granular, five-eighths inch thick, brownish-white, opaque; seed oblong, blunt at base and rounded at apex, one inch long, five-sixteenths wide, fairly smooth, cinnamon brown in color, ventral channel almost closed, germ pore slightly nearer apex than base; flavor sweet but somewhat astringent. This description was made from boiled specimens.

Lúlúí, "Pearly," sometimes spelled Lilwee, following the vulgar pronunciation. One of the latest varieties, if not the latest, to ripen at Busreh (November), usually eaten when soft. Sometimes cured but will keep only a month or two. A heavy bearer.

When fresh the variety is dull yellow in color, the flesh soft, fairly sugary and of good flavor. When cured, the fruit is broadly oval to broadly ovate, sometimes almost spherical, widest at or near center, rounded toward the rounded base and rounded or broadly pointed apex. Size small, length seven-eighths to one inch, breadth at widest point seven-eighths inch. Surface almost smooth, brownish purple to purplish brown in color, bloom very slight; skin moderately thick, tough, usually not wrinkled but separating from the flesh in occasional slight folds or blisters. Flesh soft, syrupy, three-eighths inch thick, translucent, deep, brownish amber colored. Seed oblong, rounded at both ends or broadly pointed at apex; three-fourths inch long, three-eighths broad, smooth, grayish brown, ventral channel open near base only, germ pore nearer apex than base. Flavor sweet and moderately rich; pleasant.

Madaní, "From Madína," although it is said to have been brought to Baghdád from Mecca by returning pilgrims. Sometimes qualified as Madaní ahmar (red). A long and very large date of a reddish brown color, said to be a heavy bearer; ripens midseason. Can be eaten at any stage, but is preferred when only about half ripe. Sometimes cured and packed in baskets. Said to be the largest date at Baghdád; very rare. The palm is characterized by a particularly thick trunk.

Makkáwí, "From Mecca." Two varieties of soft date are designated by this name around Baghdád. The commoner is Makkáwí ahmar (red), scarce at Baghdád but said to be more plentiful in some of the outlying oases. Medium size, good quality and large yield; ripens early in September. Eaten

fresh or packed in skins. Makkáwí ashqar (sorrel) is probably only a subvariety of the same, ripens a little earlier, and does not keep.

Malqúti, a variety reported from Hilleh, of which I could get no particulars. The name means "that which is picked up off the ground after it has fallen."

M'awa, "Like an Intestine," a long, yellow, Baghdád variety, possibly a dry date, but is usually eaten when soft. Ripens early in September and is a favorite with the people because of the honey-like character of its flesh. Has been famous for centuries; its name is a classic.

Mulaffaf, "The Twisted," a small yellow dry date of Baghdád, remarkable for the spiral wrinkles of the skin, which make it look as if it had been twisted. Very rare. Eaten either fresh or dry.

Nabaíti, named after a man or a town, a good but not common Busreh variety which seems to be on the border line between soft and dry dates. Ripens about October first. Good when fresh; must be dried in sun with care, if it is cured at all, and even then does not keep well. Shy bearer and requires more time to come into bearing than do most offshoots.

Form broadly oblong, obliquely flattened at base and broadly pointed at apex; size large, length one and one-half to one and three-quarters inches, breadth seven-eighths to one inch. Surface somewhat rough, glossy, translucent deep golden brown in color, bloom almost none. Skin medium thick but not tough, only slightly wrinkled but abundantly folded longitudinally and separating from flesh, which is firm, sometimes almost granular, thick, reddish amber close to skin, changing to light amber close to seed, not very translucent. Seed slender oblong-elliptical, pointed at both ends, one inch long, one-fourth wide, smooth, gray brown, ventral channel narrow. Flavor sweet, much resembling some of the good dry dates.

Nirsí, from the village of Nirs (?*), a good soft date grown in various districts on the river but apparently not at either Baghdád or Busreh. Ripens in the latter part of September; keeps well.

Form oblong, slightly wider toward basal end, rounded or slightly flattened at base, rounded to broadly pointed at apex. Size medium, length one and one-fourth to one and one-half inches, breadth five-eighths to three-quarters inch. Surface irregular, glossy, translucent light brown varying to orange brown; bloom unnoticeable. Skin thin, firm, tender, loosely wrinkled but adhering rather closely. Flesh firm, of caramel consistency, full of syrup, translucent, deep reddish amber in color, one-fourth inch thick, slight amount of fibre in seed cavity. Seed oblong-elliptical tapering very slightly toward both ends, length thirteen-sixteenths inch, breadth one-quarter, slightly roughened, grayish brown, ventral channel very shallow. Flavor rich, somewhat like that of Khadhráwí.

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* Al Hamdaní mentions a variety "Nirsián," from the same root.

Qaranfalí, "Like a Pink (the flower)," possibly in odor. A large, yellow, dry date of good quality at Baghdád, which ripens early in September, and can be eaten either fresh or dry. Bears well. Scarce.

Qurret Asharasí, "The Coolness (i. e., delightful freshness) of Asharasí," a Baghdád variety which is distinguished from Asharasí only by its slightly inferior size; they are sold indiscriminately together. Scarce. According to native idea, this variety is particularly sensitive to the odor of melons, and if one eats such a fruit under the palm, while the dates are unripe, they will all drop.

Riháwí, "The Fragrant," a Baghdád dry date, also eaten in its soft state. Sorrel colored, of medium size and good quality; ripens early in September; bears well; not common.

Sa'ada Aswád, "Black Happiness," a common Baghdád dry date of poor quality, but as it bears heavily it is considerably sold as food for asses. Form oblong-elliptical, flattened at base, widest near center, broadly pointed at apex. Size medium, length one and three-eighths to one and five-eighths inches, breadth three-fourths inch. Surface almost smooth, dry, slightly glossy, maroon purple in color, bloom unnoticeable. Skin moderately thick, tough, usually not wrinkled, but with a few folds and undulations; adheres closely to the flesh, which is firm, solid, one-eighth to three-sixteenths inch thick, light brownish amber in color, translucent. Seed oblong, rounded at base, rounded or broadly pointed at apex, seven-eighths inch long and five-sixteenths broad, quite smooth, russet in color, ventral channel almost closed. Flavor rather strong. This description was made from good specimens; much of the fruit in the bazar is smaller, drier and in every way inferior.

A sub-variety called Sa'ada Hamra (red) is distinguished, but it differs only in being lighter in color, and is not common.

Sáyir, "The Fibrous" (?), one of the most widely grown dates in Babylonia, although of inferior quality. It is also called Usta'amrán, and by that name is usually known at Baghdád; some experts profess to see a slight difference between the two, but their efforts are hardly successful. At Muhammarah this name is usually corrupted to Sa'amran; Sta'amran and Sambran are other vulgar pronunciations sometimes heard. The date is exported to America to a limited extent; plays an important part in native trade in the Persian gulf, and is the principal date grown on the Euphrates and the middle Tigris. It bears heavily, shortly before the first of October at Busreh, and will keep for a year or more. Said to do best in a sandy soil.

Form broadly oblong to oblong-elliptical, widest at center or slightly nearer apical end, whence it narrows almost imperceptibly toward the flattened base and broadly pointed apex. Size medium to medium large, length one and one-fourth to one and five-eighths inches, width three-fourths to seven-eighths inch; surface almost smooth, translucent, glossy, dark, orange brown in color, bloom almost unnoticeable; skin rather thick and tough, smooth except for occasional wrinkles or longitudinal folds in which it separates from the

flesh, which is rather soft, syrupy, one-fourth to three-eighths inch in thickness, deep amber colored, with considerable tender fibre around seed; the latter broadly oblong, rounded to blunt at both ends, three-quarters inch long, five-sixteenths broad, fairly smooth, grayish brown in color, ventral channel nearly closed, germ pore nearer base than apex; flavor very sweet, not cloying, but not rich or distinctive in any way. The dark color of the date is its principal drawback. Has done well in United States.

Saba'a al Dra'a, see Bú Saba'a al Dra'a.

Sayyid Ibráhím, (a man's name), is one of the largest of the Baghdád soft dates, but rare. Long in proportion to its width; light brown in color; ripens midseason; eaten fresh or cured; bears heavily.

Shaqra, see Ashqar.

Shakkar, "Sugar," often called Shakkarí,* an inferior Busreh soft date, not to be confounded with those of similar name at Baghdád. Of medium length and slender, light brown in color, ripening late in September; a shy bearer; not common. Eaten principally fresh, but will keep a month if dried.

Sharisí, "Of a bad disposition," a fairly common Baghdád variety but on account of its poor quality is usually eaten only by animals, for which reason the cultivator usually does not pollinate it. A long and slender but small date, light brown in color; can be eaten fresh or packed in skins or boxes. It is often called Shís, "unfertilized."

Shatwí, "Wintry," the latest of the Baghdád dates to ripen (November) but of fairly good quality. Usually eaten fresh, but keeps well. Not common.

Form oblong, widest at center or toward basal end, flattened at base and blunt to broadly pointed at apex. Size medium, length one and one-quarter to one and one-half inches, breadth three-fourths to seven-eighths inch. Surface dry, roughly undulating, opaque dull magenta in color near base changing to translucent deep amber brown near apex; bloom very slight, blue gray. Skin dry, firm, rather thick and tough, coarsely wrinkled and blistered, adhering closely around base but often separating toward apex. Flesh solid, meaty, three-eighths inch thick, translucent amber brown in color, rather fibrous around seed, which is oblong, slightly swollen in center, base and apex rounded, length seven-eighths inch, breadth three-eighths; smooth; light

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* This, again, is a Persian word; the Arab form "sukkar" is, also, in use at Baghdad, both for the article *sugar,* and as the name of a date variety. Our word "sugar" is, of course, of the same origin, all three forms deriving from the Sanskrit *cakara,* which meant either sugar or—sand! One of the commonest Arab methods of forming a date variety-name is to make an allusion to sugar in some way; such is the excellent Baghdad variety Tabirzál, which was originally Tabirzád or Tabarzadh, a Persian word again. Cf. a classical Arab lexicographer's definition of "sukkar": "A certain sweet substance, well known; it is hot and moist, according to the most correct opinion; but some say cold; and the best sort of it is the transparent, called Tabarzadh; and the old is more delicate than the new; it is injurious to the stomach, engendering yellow bile; but the juice of the lemon and orange counteract its noxiousness; it is said to be a word recently introduced, but some say that it occurs in one Tradition" (of Muhammad. The use of a word by the Prophet is the highest recommendation it can have for etymological respectability).

brown; ventral channel open but shallow, germ pore slightly nearer apex. Flavor rather strong, but nutty, somewhat similar to that of a good dry date.

Sin Mufta, a variety mentioned by Colvill,* which I could not identify.

Shuwaythí, "The Little Bees' Date" (?), a Busreh soft date resembling Khadhráwí but a little smaller. Ripens in October; not good when fresh but fairly good when cured; keeps eight or nine months. Scarce and a shy bearer.

Tabashir, "Calcareous," probably from its chalky color, a variety of which I could get no more than the name. Doubtless a dry date.

Ukht Badra, "Badra's Sister," a name which indicates the similarity of this dry date of Baghdád to the distinct and commoner Badráhí. A rare variety, but sometimes found in the bazar.

Form oblong, slightly wider toward apical end, flattened at base and rounded to broadly pointed at apex. Size medium large to large, one and one-fourth to one and five-eighths inches long, seven-eighths to one inch wide. Surface dry, hard, smooth or somewhat undulating, dull yellowish brown in color, sometimes brownish yellow. Skin thin, dry, rather tender, occasionally slightly wrinkled or creased. Flesh three-eighths inch thick, light yellow near skin, changing to silvery white near seed; solid and meaty, but neither mealy nor brittle; dry, slightly fibrous around seed. Seed broadly oblong, rounded at base and apex, seven-eighths inch long, three-eighths wide, smooth, gray brown, ventral channel deep, germ pore slightly nearer apex. Flavor sweet and nutty.

Usta'amrán, "The Date of 'Amr the Expert" ('Amr is a common man's name). A synonym for Sáyir, q. v.

Umm Ajrabeh, "Mother of Quantity" (the ajrabeh is a grain measure containing 768 pounds) or "Mother of the Mange". If taken in this last sense, the name probably means that the palms of this variety are particularly affected by the Parlatoria scale, which is colloquially known as "date-palm mange". A rare Baghdád soft date, much similar to Khustáwí in appearance, but a little smaller. Ripens in midseason. Noted as a heavy bearer, as the first signification of its name would indicate.

Umm al Sawání, "Queen of the Table" or, more literally, "Mother of Platters". The name is colloquially pronounced Umuswani. A small, short, fat date known at Baghdád, but confined to a few gardens. It is eaten only in the fresh or rutab stage, when its color is a brownish yellow.

'Uyun Ayub. The latter word is the name, in Arabic form,† of the Biblical Job, the former has some fifty meanings in addition to its primary one of "eyes," As Job's Eyes seems senseless, I suggest (without any definite warrant from Arab sources) the translation "coins" which is etymologically

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* In Jour. Linn. Soc. London, vol. XIV, p. 505.

† The translators of the King James version of the Bible blindly copied Martin Luther in transliterating proper names, without stopping to think that the difference between German and English was wholly misleading in such cases as this. Job and Jacob would pass in German, where they correctly give the oriental pronunciation; but in English, with a different value for *j,* the translators should certainly have written Yob, Yacob, etc.

entirely justifiable. The name could then be linked to the Arabic tradition given by Shaykh Jalal al Dín (15th c., A. D.) in his Commentary on the Koran, and elsewhere, that Job had two threshing floors, one for wheat and one for barley, and that after his prosperity had been restored, God sent a cloud over each of these threshing floors, raining gold pieces on one and silver pieces on the other, until they were wholly covered. The fruit which bears this name is a rather small, yellow, dry date of Baghdád, scarce but esteemed. It ripens in midseason and the yield is said to be average.

Zahríyeh, "Flowery" or "Brilliant," a variety mentioned by Ghanimeh, but unknown to me personally.

In addition to these, Dr. Zwemer* mentions the following as being dates of the Busreh region: "Mother of Perfume," "Sealed Up," "Red Sugar," "Pure Daughter," and "Daughter of Seven." I can not be certain of these identifications; but "Mother of Perfume" may be Ríháwí; "Sealed Up" is probably Maktúm; and "Daughter of Seven" is probably the same as "Father of Seven to the Cubit."

I may add that of the 111 varieties of dates described in Baghdád by native writers of the eighth, ninth and tenth centuries, and collected by Pére Anastase Marie of the Carmelite Mission, Baghdád,† not more than fifteen or twenty can be identified definitely as existing up to the present day. Some of them are probably now going under other names; but no doubt most of them have become extinct, as better varieties took their places.

Male Varieties.

The principal variety of male date palm in the Busreh region is Ghanamí, "Bushy Head," which gives pollen in its third year, blooms early in the season, and produces from twenty to thirty spadices annually.

Other male varieties of this region are Hukrí, whose name signifies, probably, "what is laid by in times of scarcity" and points to the storing of pollen from year to year (although such a practice is extremely rare in Babylonia), Wardí, "Long Haired", and Sumaysmí, which is probably a colloquial pronunciation of Shumaysmí, "little Sunburst," in allusion to the thick crown of foliage.

At Baghdád a dozen or more varieties of males are distinguished, merely by the name of the female variety of which they are originally supposed to have been seedlings (although now propagated by offshoots, of course). The best of these is Asharasí, which sometimes bears forty or fifty spadices, the Arabs claim; and they declare that not only is the yield of fruit heavier when this variety of male is used for pollination, but that the flavor of the dates is also better. It is, accordingly, the only variety planted by connoisseurs, but lacking this, Bárbán is preferred, with Khadhráwí in third place.

In importing specimens of the male Asharasí to California, I endeavored

* Zwemer, S. M., in "Arabia, the Cradle of Islam." New York, 1901.
† See Loghat el Arab, XI, 509, Baghdad, Mai, 1913.

to avoid confusion with the female by dropping the last syllables and adding the Arabic word for male; so it now appears as Ashar Fahal.

It is worth noting that the classical writers do not, apparently, know any named varieties of male, but mention merely "Fahal" or, in the plural, "Faháhíl."

In order to complete private files and in order to obtain special articles which appeared in the first number of this JOURNAL, namely, that for February, 1911, numerous requests have been received for copies of that issue. Since the supply of that number at Pomona College has been exhausted, the editor will be pleased to purchase a number of copies from persons willing to sell them at twenty-five cents each.

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cannot most intelligently and efficiently direct others in any great industrial work, without understanding to a finish the basic scientific principles underlying that work and

without being able to do the things himself

CHARLES FULLER BAKER, M. A.

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AND SUBTROPICAL HORTICULTURE

Volumes One, Two and Three

1911-1912-1913

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BY THE

DEPARTMENT OF BOTANY, POMONA COLLEGE

CHARLES F. BAKER, Editor

A Backward Look and a Forward Look

By DAVID L. CRAWFORD
Professor of Botany in Pomona College

With this issue the third and final volume of the Pomona Journal of Economic Botany is closed. In a new form, however, and under a new name it will be continued. Begun in 1911 by Professor Charles Fuller Baker, the Journal has contributed richly to the advancement of subtropical horticulture in California. Each number has been filled with valuable and interesting information and illustrations. Professor Baker's connection with the Journal ended in 1912 when he accepted a position in the University of the Philippines as Professor of Agronomy in the College of Agriculture. Unfortunately for the Journal, it was impossible for his successor to issue the quarterly numbers when they were due, because of certain difficulties. During the two years in which the second editor issued the Journal only four numbers appeared, dated and numbered according to their due time of issue. The third editor, the present writer, now takes up this work.

It is gratifying, in retrospect, to see the signal success to which this Journal attained from its beginning. This success was due chiefly to two factors, namely, the unique ability of the first editor, and the great need in this country for such a publication. There are few men living who have a greater capacity for work and who are more tireless in their work than Charles F. Baker. He is a man who sees big visions and who, instead of dreaming, sets about with joyful zeal and a bulldog determination to make these visions realities. As a friend, one can want no better. As an enemy, one never is in doubt as to his opinions and sentiments. He is open-hearted and large-hearted. One feels a strong stimulus to a better and a larger life when he comes into contact with this man.

Mr. Baker saw the need for a publication of this kind in California, which would disseminate practical knowledge concerning the subtropical trees and plants and fruit crops which are or might be useful on the Pacific Coast. The Pomona Journal of Economic Botany was the only journal of its kind in the entire country and met with much demand, for this is essentially a subtropical region and not far away in several directions are tropical countries. The horticulture of this country is sure to become more and more like that of the tropics, and to hasten this development was the object of the new publication.

This need is increasing in all southern countries, especially in the southern portions of the United States. Tropical agriculture and horticulture are becoming very important in the economy of the world today. More people are going south to engage in the more profitable tropical agriculture and more money is

being thrown into its development. More schools and colleges are springing up to teach the science and practice of this branch of agriculture. All over the world it is becoming of vast importance.

A publication such as was begun by Professor Baker cannot now be limited to a small region. It must be broad in its scope and must be useful in developing and advancing all branches of tropical and subtropical agriculture and horticulture in all parts of the world where they are practiced. Toward this end, a change is to be made in the Journal. It will be issued under a name name, with new policies and a broader scope, and by a large group of the world's foremost experts in tropical agriculture. A further notice of this will be issued at a later date, when the plans are more nearly complete.

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